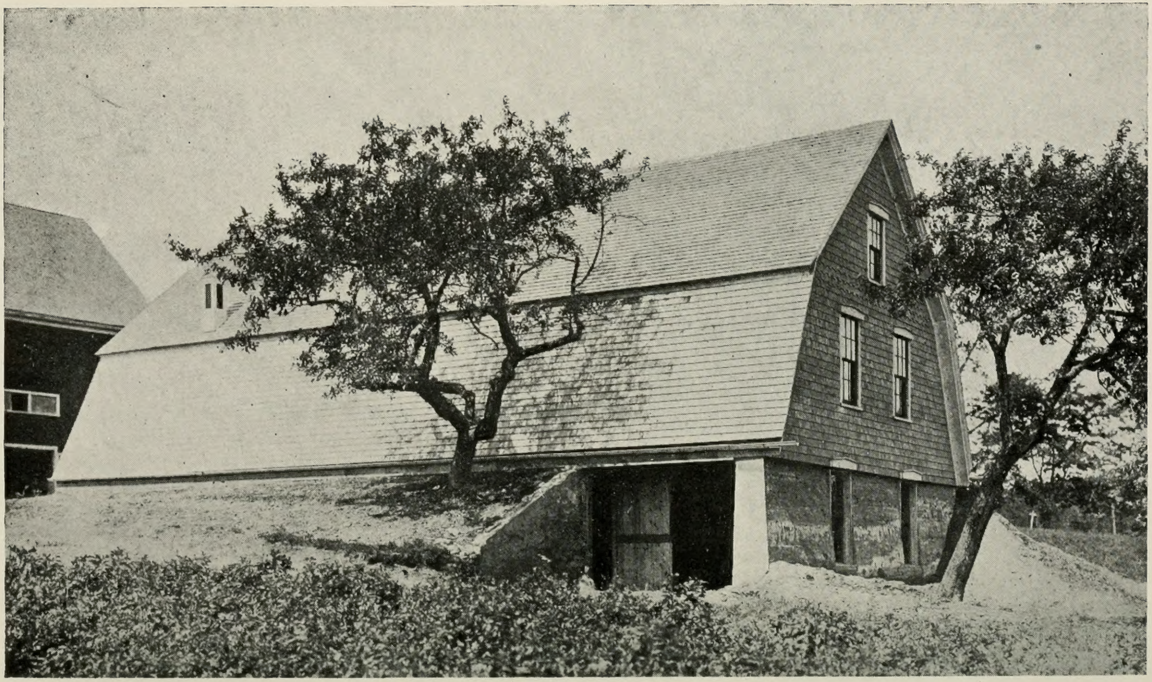
REPORT

OF THE

AGRICULTURAL COMMISSIONER

MAINE 1906



MAINE FARMER PRESS, AUGUSTA

A modern potato cellar. Storage capacity, 6,000 bushels

FIFTH ANNUAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

STATE OF MAINE.

1906.

AUGUSTA
KENNEBEC JOURNAL PRINT
1907

DEPARTMENT OF AGRICULTURE.

To the Honorable Governor and Executive Council of Maine:

In compliance with chapter 204 of the public laws of 1901, I herewith submit my fifth annual report as Commissioner of Agriculture of the State of Maine, for the year 1906.

Augusta, January 1, 1907.

A. W. GILMAN, *Commissioner.*

ANNUAL REPORT OF THE COMMISSIONER OF AGRICULTURE.

In reviewing the work of this department for the past year, we feel that encouraging results have been obtained. Our State is showing a continued progress in agricultural lines, and is becoming pre-eminently an agricultural state. Its agricultural resources and possibilities are every year more fully realized. Our efforts to interest the farmers in acquiring the knowledge which is essential to the highest success in their calling, have been attended with a good degree of success. The farmers' institutes have been largely attended, and an increasing interest manifested in the reports and bulletins published by the department, and in all the methods by which we have endeavored to disseminate information along advanced agricultural lines. The courses in agriculture at the University of Maine have been more fully attended than ever before, and the extension work of the University, aided by this department and the grange, has been productive of much good.

FARM CROPS.

Although the past season has not been an especially favorable one for all farm crops, the aggregate production exceeded somewhat that of former years. A good hay crop was harvested, in fair condition. There was a substantial increase in the acreage of potatoes, and notwithstanding the fact that the yield in some sections was not as large as in average years, the entire amount of the potato crop of the state exceeds that of 1905 by several million bushels. Potato culture has received a great deal more attention this year in the central and western part of the State than ever before, and in some localities the land is very well adapted to this crop. The amount of the apple crop was con-

siderably less than in 1905. The quality of this crop has been improving from year to year, as the fruit growers of the State are giving it more intelligent care. The other farm crops have received their usual attention. Although in some sections the acreage of tilled land has decreased, farmers as a rule are giving each acre increased cultivation and attention, and are receiving more for the amount of land worked and the time employed. The average farmer within the past few years has been studying more carefully the conditions of his soil and what it requires to produce the best results, with the various crops; and with the increased knowledge which he is gaining, he understands better how to control weather conditions and insect and plant diseases than in former years. Science has also aided much in developing the plant food in the soil so that the plant may find ready access to it in the early stages of its growth, and in the invention of labor saving machinery.

OUR LIVE STOCK.

We believe the quality of the animals kept upon our farms as a rule is continually improving. While we regret to learn from the report of the Board of State Assessors for 1906 that in several classes the numbers have decreased somewhat, yet it is our opinion that the increase in individual value is such that the total value of our farm stock has been increased. This increase in value is especially noticeable in the case of our dairy cows, and we are glad to know that the dairymen are realizing more fully than formerly the necessity of improving the quality of their cows, in order to obtain the best success in their business.

We regret to find that the number of sheep in Maine has further decreased. We still feel that this industry offers many inducements to our farmers. The product of the sheep, both in wool and lambs, is bringing an increased price from year to year. There is no branch of stock husbandry that the farmer can engage in that is so sure of yielding a large profit as this industry.

The high price of poultry products during the past year has given an encouraging aspect to the poultry industry, and this is receiving increased attention. Many of our farmers are realiz-

ing that a small flock of hens intelligently fed and cared for will add an appreciable amount to the yearly income, and in some sections the business is carried on quite extensively, with good success.

THE DAIRY INDUSTRY.

The dairy interests of the State have received much attention during the past year, and we are pleased to note a marked progress in this line. The quality of our dairy products and the methods employed in their production have steadily improved. Through the efforts of our efficient State Dairy Instructor much has been accomplished for the benefit of both producer and consumer. The milk supply of the principal cities and larger towns has been thoroughly investigated, and the illegal sale of imitation dairy products carefully looked after. The inspection of creameries, and of dairies as far as practicable, has been continued. Much has been done in the line of promoting a spirit of cooperation between the creamery operator and the patrons.

The report of the Dairy Instructor, which appears in this volume, will give in detail the work of the year.

INSECT PESTS.

The work of disseminating information in relation to, and suppressing, dangerous insect pests, has been faithfully carried on. All nurseries and many orchards have been inspected, and much work done among the schools and granges. A vigilant educational campaign against the brown-tail moth has been kept up. Cities and towns, as well as individuals, in the infested district, as a rule have manifested much interest, and many of them have done excellent work in the destruction of this pest. A very large number of winter nests have been destroyed, thus preventing immeasurable ravages among our fruit and shade trees. While we cannot expect to completely exterminate this insect or entirely check its spread, until some parasite is found to aid in its control, if every city, town and individual owner of infested trees will use their best efforts to keep their property free from the pest, its devastations will be greatly reduced. A continual warfare must be kept up.

In August Dr. L. O. Howard, Entomologist of the United States Department of Agriculture at Washington, visited this

State and held three important meetings, in connection with the officers of the Pomological Society and others who had been at work in the suppression of the brown-tail moth, for the discussion of matters relating to this pest and to the gipsy moth. As the gipsy moths had been found in Portsmouth, N. H., Dr. Howard was apprehensive that they might have crossed the line into Maine, and promised to send a scouting party into the State, to make a thorough search in the border towns. This party arrived Nov. 20, and from that time until the close of the year they found egg clusters of the gipsy moth as follows: Kittery, 230; York, 190; Eliot, 32; Wells, 47; Togus, 1; total, 500.

This pest is such a serious menace, not only to our fruit and shade trees but to our forests and lumbering interests, that its appearance in the State has caused much alarm. We trust the coming legislature will realize the gravity of the situation and take some measures looking to its control or extermination.

FARMERS' INSTITUTES.

A good interest has been manifested in the farmers' institute work during the past year, and the character of the instruction at these meetings has been of the highest. It is important that the farmer should know what has been done and what is being done by others engaged in the same occupation, and the farmers' institutes are a valuable source of obtaining information in these lines. They awaken the farmers to a sense of their opportunities, and show them how to take advantage of them. Thirty-four regular institutes have been held during the year, in the different counties of the State. The following speakers from out of the State have been employed: Prof. L. R. Jones, Burlington, Vt.; Prof. F. S. Cooley, Amherst, Mass.; Prof. C. D. Smith, Director Michigan Experiment Station, Agricultural College, Mich., and Dr. H. P. Miller, Sunbury, Ohio. The speakers from our own State have continued to lend us their valuable assistance, and have contributed much to the success of the meetings. Among the subjects which have been discussed are, Grasses and their Culture; the Feed and Care of the Dairy Cow; Home Mixing of Commercial Fertilizers; Clover and Alfalfa; Some Common Ailments of Animals and their Remedies; Sanitary Conditions of the Home and Stable; Economical Rations for Dairy Cows; Fruit Culture, and Agricultural Education.

A new feature in this line of work introduced during the past year was the holding of farmers' institutes in connection with the Maine Farming Special train sent out from the University of Maine, which made two trips in the state, one from April 23rd to May 5th, in Penobscot, Waldo, Piscataquis and Aroostook Counties, and the second, June 14 to 30, in Penobscot, Hancock, Washington, Waldo, Somerset, Kennebec, Franklin, Androscoggin, Cumberland, Sagadahoc, Lincoln and Knox Counties. During the first trip 31 meetings were held, and during the second, 43. At each one of the 74 stops made there were assembled from 100 to 1500 people. A careful count of the number passing through the train at a number of places justified the estimate that fully 75,000 people visited the train in the course of its three weeks on the road. A stop of two hours or more was made on each occasion. The program followed was to have two or three short talks given on subjects especially applicable to the location. For instance, in a fruit growing community special attention was given to horticulture, particularly apple growing. In others, stress was laid upon the potato crop and dairying; and in still others, poultry interests and forestry were discussed. After the talks the visitors were invited to ask questions of those in charge of the exhibits. One farmer was heard to remark that his visit to the train would be worth $500 to him during the present season. Other remarks of similar nature showed the value of the exhibits and the explanation given. Wherever the train made its last stop for the day, an evening lecture was given, illustrated by stereopticon. Views were shown which illustrated the history and development of the College of Agriculture of the State University, particularly in the growing of hay and greenhouse crops and illustrations of animal types.

The train consisted of three baggage cars fitted up as exhibition cars, and one coach for the convenience of the speakers and exhibitors. The exhibits consisted of dairy machinery and appliances, poultry houses, brooders and incubators, trap nests and feed boxes; brooders with live chickens, illustrating the method of feeding; miniature fields with growing plants, showing the rotation of crops and soiling crops suitable for Maine; illustrations of orchard management, including various methods of grafting and cures for diseases of trees. Methods of mixing fertilizers at home were shown, as also illustrations in general

gardening and the value of good seed. The forestry exhibit was enriched by large transparencies sent from the Department of Agriculture at Washington, and samples of the manufacture of paper in the State, with illustrations of the process from the tree in the forest to the completed product. Not the least valuable and interesting of these exhibits was the entomological exhibit, in charge of an officer of the State Department of Agriculture. This was particularly valuable inasmuch as the gipsy moth and brown-tail moth have begun the invasion of the State of Maine. All of these exhibits were in charge either of officers of the State Department of Agriculture or professors from the College of Agriculture of the University or advanced students from the College.

The enthusiasm of the people who visited the train and who attended the evening lectures gave sufficient assurance that this new method of bringing the University to the people and of conducting institutes with the use of actual agricultural apparatus on hand for illustration, is a success. While other states have had trains to illustrate the raising of corn or of cotton, and on the Pacific Coast the growth of fruit, we believe that this train in Maine was the first in the United States to illustrate all the features of general farming. If it is not the first in the United States, it is at least the most important attempt to carry to the farmers themselves in their own homes a considerable amount of the instruction which is offered at the College of Agriculture. There were numerous instances of people walking through the woods many miles in order to visit the train. This was necessitated by the almost impassable condition of the roads in the latter part of April. Even those who exerted themselves to this extent seemed well satisfied with the result of their journey. Many expressions were heard commendatory of the railroads which made this Farming Special a possibility, and of the efforts of the State Department of Agriculture and the University in furnishing the men and the labor necessary to make it succeed. Many people expressed the desire that such a train would be run every year. While it will probably not be practicable to run it every year, it may be possible that it can run often enough to stimulate the interest throughout the State in approved methods.

AGRICULTURAL SOCIETIES.

The agricultural societies of the State have met with about the usual amount of success during the past year. The exhibitions held by our three state societies were unusually large and instructive, and at many of our county fairs the display of stock and farm products was exceptionally fine. We are pleased to note an increasing tendency, on the part of some of the societies, to adhere more closely to the lines of a strictly agricultural fair. It is our opinion that this policy will not detract from the financial success, and that such fairs will have more influence upon the improvement of agriculture.

The following figures show the business of these societies for 1906.

Number of horses and colts exhibited	1610
Number of neat cattle exhibited	5511
Number of sheep exhibited	1149
Number of swine exhibited	512
Number of poultry (coops) exhibited	3439
Amount of premiums and gratuities paid	$23,282 24
Amount of trotting purses	$20,239 23
Per cent of premiums and gratuities to total awards	53
Per cent of state stipend	37.28
Number of societies receiving stipend	40

THE WORK OF THE OFFICE.

The amount of work which is necessary to be performed in the office of the department has been continually increasing. The correspondence is very large, and the work of suppressing the brown-tail moth and other duties which have been added to the department within recent years have largely increased the clerical work. The publication of the annual report and quarterly bulletins has been continued and our effort has been to make these of increasing value and interest to the farmers of the State.

AGRICULTURAL DEVELOPMENT.

A prosperous agriculture is the foundation of a prosperous country. This industry outranks all others in value of product and importance to our welfare. When our farms produce abundantly commerce is increased, transportation facilities are multiplied, and all other industries are sitmulated. An important factor in the improvement of our agriculture is the adoption of progressive, up-to-date methods. Changing methods must follow changing conditions. Development in agriculture must keep pace with the rapid development in other lines. Our farmers are manifesting a greater and more intelligent interest in agriculture in all its branches, and making greater progress in the science of their business. They are watching the experiment stations more closely and relying upon them for the working out of some of the important questions that have so much to do with increasing the productiveness of the soil. With a fuller realization of our agricultural resources, a careful study of our conditions, and the bringing of business and scientific methods into our farming, we believe our agriculture will continue to develop in the future even more rapidly than it has in the past. Some of the most studious, intelligent men of the State are now giving the best that is in them towards the development of this great industry.

INSTITUTE PAPERS.

POTATO DISEASES AND THEIR REMEDIES.

By Prof. L. R. Jones, University of Vermont.

There is nothing more important to the highest success than a sense of confidence in the mastery of one's business. This is especially true of the farmer. In certain phases of crop production no other thing has so diminished this confidence as the baffling experiences often had with plant diseases. Most men soon learn to handle the normal plant under good conditions, but when the dreaded blight or rust appears they lose their grip.

Formerly it was commonly held that such diseases were divine visitations and that any attempt to check them would be an interference with the workings of Providence. More recently we have learned that for most of these diseases there is a specific parasite—an insect or a fungus which causes it. Realizing this, our confidence in the efficacy of specific remedies, of insecticides and fungicides, has rapidly increased. The results of spraying in late years have indeed been most encouraging, and it is an important part of my message to stimulate more and better spraying. But I first wish to emphasize the point that spraying alone is not everything—or even the most important thing—in growing potatoes or any other crop. Each year brings the fuller realization that the first thing is to learn more fully how the normal plant feeds, develops and reproduces itself, that by intelligently aiding it in these processes we may secure its fullest possible vitality. Having done this we may finally gain great profit by intelligently spraying to preserve that health and vigor. The point I would emphasize at the outset is that spraying does not make sick plants healthy, but instead it keeps healthy plants from becoming sick.

The Commissioner of Agriculture has asked me to discuss the diseases of the potato and their control, and I especially wish to

emphasize the importance of this viewpoint in approaching the subject. It will not suffice merely to catalogue the diseases of the potato and advise as to when to spray for each. Some more fundamental notions are needed regarding the history and development of the potato.

The potato is the most commonly cultivated plant of our fields and gardens. Yet it is the most variable in yield of our standard crops and the most liable to diseases and failure from causes the least understood. Why is this? A partial explanation may be found in the fact that it is a semi-tropical plant which has been brought under cultivation in the northern climate by rapid and intensive breeding. Our season of growth is shorter by one-third, or even one-half than that of its natural habitat. There it reproduces itself primarily by seeds, and secondarily by tubers. Here, by breeding and selection, man has so changed the conditions that seed production is almost unknown, while the size and number of the tubers are enormously increased.

For information upon these points I am largely indebted to Mr. Cyrus G. Pringle, the veteran botanical explorer, who is thoroughly acquainted with the potato, both wild and cultivated, as it occurs in Mexico. In the gardens there it is planted in March and harvested in December. The period of blossoming and maturing of seed is in August and September, whereas the tubers are formed one or two months later.

Reproduction by seed is a sexual process, that by tubers is vegetative. Both are exhaustive of vital forces. The two are, therefore, in a physiological sense opposed, and cannot well be carried on at the same time. Under the natural condition of the wild plant the seed precedes. With our shorter season and intensive culture we have crowded the two processes together until they tend to overlap. That is, we have forced the tuber production back into the period which in the wild plant is given to the production of flowers and seeds. As a result we have, just after the potato plant comes into blossom, a strained and unnatural condition; a state of physiological tension, of stress between two opposing vital tendencies. According to the mode of its ancestors the major part of the plant's energy would then be tending upward toward flower and seed; but tuber production in the high-bred specialized plant begins immediately and the acquired tendency is for this process to claim the major part of the food.

As a result of this conflict of tendencies in the plant there occurs a *critical period* during which the continued health of the plant, if not its very life, hangs in the balance.

Whether this explanation is correct or not, the fact is certain that the fortnight including and immediately following the blossoming period is the turning point, the crisis in the life of the potato plant.

The production of a profitable crop depends more upon its protection at this period than at any other during its growth. Before this time it will quickly recover from very severe ravages of insects; a little later it will do the same; but serious injury to the foliage or arrest of development from unfavorable soil conditions at this period will start the plant upon a decline which is disastrous to the crop of tubers and leads to the premature death of the plant; and, in our experience, no subsequent treatment makes amends for neglect at this time. If, however, the plant is carried in full vigor through this critical period it starts upon what is virtually a new lease of life, a vegetative period which, with the more vigorous varieties in our northern climate seems to have no natural terminus. The length of the subsequent period of vegetative development seems dependent not on internal factors primarily, but on external conditions, chiefly climatic, which have so varied at Burlington during recent years as to bring successive crops of the same variety and on the same soil to so-called maturity at dates varying from September 25 to November 10. It is during this second or vegetative period that all of the marketable crop is developed. It is for this that we have grown the plant, and it is important, therefore, to inquire more exactly when and at what rate this development occurs. In order so to trace the relative rate of growth of the crop, we have during three seasons at the Vermont station made a series of partial diggings at ten-day intervals from the blossoming period through to full maturity with vigorous varieties, carefully cared for and sprayed. This has covered a period of about seven weeks, and has revealed the important fact that there is fully as great a rate of growth during the last half as during the first half of this seven-week period. The following results of one such season's digging is typical of them all.

THE DEVELOPMENT OF THE POTATO TUBER.

White Star potatoes, planted May 20th, at Burlington, Vt. Yields and size of tubers at different dates.

Date of Digging.	Total yield per acre.	Yield of marketable size.	Average size of Tubers.
August 2	58 bushels	30	1.6 ounces
" 12	115 "	75	2. "
" 22	230 "	163	3.7 "
September 1	304 "	234	4.4 "
" 12	356 "	303	5.2 "
" 22	379 "	353	5.7 "

It is noteworthy as indicating how little the fundamental importance of the continuous health of the plant during this vegetative period is appreciated, that the date of its beginning

FIGURE 1. Tip-burn of the potato leaf. Primarily due to insufficient water but increased by any other unfavorable condition.

is almost coincident with that when the average potato grower abandons his plants to weeds, insects and blights. The thrifty New England farmer is ashamed to have his neighbors see weeds or bugs in his fields before this period, but, on the other hand, he feels called upon to defend, if not to apologize for his course, if later than this he pulls weeds, or sprays to protect his plants. Yet the beginning of this vegetative period is the very time when certain insects, notably flea-beetles and grasshoppers, do their worst work; and it is often serious work, indeed. If a period of dry weather follows, and if the soil is either caked or weedy, tip-burn is the inevitable result; and when this begins it is as a rule prophetic of the steady decline of the plant to its death. Tip-burn is a physiological disease due to inadequate water supply. The potato requires more water than do most plants; indeed, the production of a full crop demands that fully one-fourth of all the water that falls on the soil during the entire season shall be absorbed by the plant, and either retained or cast off through its leaves. Moreover, the time of most active demand for this water is at and shortly following this critical period. The securing of this water supply is dependent upon three things. First, the water-containing character of the soil, determined by humus-content and thorough pulverization. Second, surface tillage to conserve this. Third, healthy foliage to carry on transpiration, which is the pumping process in plants. Much of the so called "blight" of potato foliage is really tip-burn, due to insufficient attention to one or all of these things.

Starch manufacture is scarcely second to water supply in importance for tuber formation; this occurs entirely in the green leaves under the invigorating influence of sunlight. The extent of healthy leaf surface is, therefore, an exact index to the capacity for starch formation. When it is remembered that one-half of the possible crop may be formed after the third week in August, the importance of the preservation of the healthy foliage through the early autumn becomes apparent. Certainly the average potato grower has no just conception of his dependence upon this late foliage for a full crop. As evidence of this we are frequently asked by intelligent farmers whether there is not danger of their plants "running to tops" as a result of the spraying, and whether, in that case, they should not prune

FIGURE 3. The fleal beetle enlarged 5 times.

FIGURE 2. Potato leaf badly injured by the flea beetle. All the smaller holes in the interior of the leaf were cut by this insect. The edges of the upper leaves were cut away by the common bug or Colorado potato beetle.

them back or break them down. In one case recently a man who had sprayed and thus secured a fine stand of healthy plants was advised by his neighbors that he was ruining his crop and must cut the stems back. About the middle of August he wished us to visit his field and advise him in the matter. We

did so, and offered on behalf of our Experiment Station to pay him for possible loss if he would cut back the tops by one-half in alternate rows in his field and report the outcome to the Station. The result was a yield of 152 pounds where pruned as compared with 221 pounds where unmolested.

But the greatest enemies of the New England potato crop in this latter stage of its development are the diseases due to fungi or bacteria—the blights and the rots.

In addition to the "tip-burn" already mentioned two forms of leaf blights annually occur. First, the Early Blight appears in July, a fungus disease causing well defined black spots with minute target-board like rings as markings on them. This disease is worst on dry, sandy soils and in the dryer parts of the season. Fortunately this early blight rarely destroys all the leaves and it never spreads to the tuber or causes rot. The fungus which causes it lives over winter probably on the dead stalks and leaves. From July first on one sees— at least in Vermont fields—much spotting of the leaves closely resembling the early blight, but of wholly different cause. This is the "burning" or spotting by Paris green or other insecticides.

The Late Blight, as indicated by its name, is usually delayed four weeks or more, generally appearing in late August. Once underway it spreads through the field with alarming rapidity, as all know too well, providing it is favored with warm, moist weather, often blasting all within a week. Moreover, its damage does not cease here, for the same fungus passes to the tubers, thus starting the dreaded rot. This is started by the germs or spores which wash from the blighting leaves through the soil until they reach the tuber.

If conditions are favorable the fungus upon gaining entrance to the tuber spreads rapidly through it, killing parts or all of its tissue and leading to either the "dry" rot or the "wet" rot according as more or less water is present in the soil. In wet soil the fungus not only destroys the tuber rapidly, but spreads to other tubers. If conditions are different the development of the fungus in the tubers stops without causing visible injury and it may remain dormant in the tuber over winter. We are without positive evidence that this fungus can live over winter in the dead plants or in the soil and it is believed that it is only through the use of infected tubers for seed that the disease is perpetuated year by year. Unfortunately there is no practical

way of disinfecting such tubers since the fungus rests securely buried within their flesh.

The potato scab—often troublesome locally—is another fungus disease, of which the germs live over winter on the surface of infected tubers, and often of those that appear sound. It also lives over in the soil, apparently persisting indefinitely in a soil which is rich in humus and lime.

While other potato diseases are known, it is believed that most of the serious loss in New England is due to one or another of the causes already mentioned.

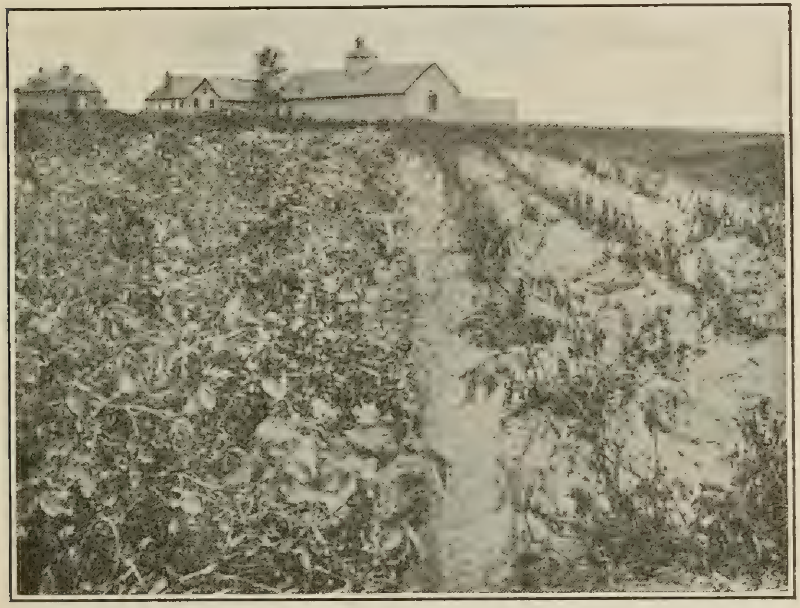
Having catalogued the diseases as to their causes let us now note the more practical side of the matter—the remedies.

In the first place let the emphasis again be laid on the importance of more attention to soil conditions—humus and tilth—and to cultivation with the view of securing the fullest vigor of plant and conserving for its use the available moisture. These prevent tip-burn and make the large crop possible providing the other diseases are warded off. How then is this last step to be taken?

Precautions against scab must precede the planting. If the germs are already in the soil the only way is to avoid planting to potatoes for a number of years—five at least—and meanwhile the land had best be in grain or grass crops. But it is easily possible to guard against the other source of danger—viz., seed infection. This is effectively done by disinfecting either with formalin solution (1 pint formalin in 32 gallons water, soak 2 hours) or corrosive sublimate solution (1 oz. corrosive sublimate in 8 gallons water, soak 1½ hours). For larger growers it may prove easier to fumigate with formalin vapor. Our results have indicated that if properly done this is fully as effective. The formalin may be vaporized either by evaporating over a lamp or by the permanganate method.

The use of 3 pints of formalin per 1,000 cubic feet of storage space is advised. This may be directly vaporized over a lamp, but the permanganate method of generating the gas advocated by Evans and Russell of the Maine State Board of Health is preferable. Place 18 ounces of potassium permanganate in a 3 gallon earthen bowl, pour the 3 pints of formalin over it and at once leave the room, closing it as tightly as practicable for 24 to 48 hours.

As the crop develops the potato bugs appear and are to be poisoned promptly. Where Paris green or other arsenites are used care needs to be taken to prevent the burning of the foliage already described. We apply these poisons with a spray pump in water and avoid all danger by mixing the poison with lime. We slack 2 pounds of stone lime for each pound of the poison, stir the poison into the lime while the lime is hot and let stand several hours before using.



SPRAYED. NOT SPRAYED.

FIGURE 4. Showing the gain from Bordeaux mixture in checking insect injuries. There was practically no blight on this field, the gain resulted chiefly from the fact that the Bordeaux mixture kept the sprayed rows free from flea beetles and grasshoppers. It also reduced the amount of tip-burn.

Closely following the common potato bug comes that other pest—the flea-beetle—which refuses to be poisoned. Fortunately it has a great repugnance for Bordeaux mixture. Consequently we begin the use of that mixture, with poison added, early enough to stop his work. The middle of July with us suffices to forestall both flea-beetle and early blight, and we start with the combination Bordeaux-Paris-green mixture about that date. Often with late main crop potatoes a later beginning is equally efficacious. If in any doubt, however, *begin to spray*

early, since these remedies are preventives, not cures, and their use must precede the diseases they are directed against. The mixture as we use it consists of 5 pounds each of copper sulphate and lime with ½ pound Paris green per barrel of 50 gallons of water. Where applied thoroughly and in season this combination has proved almost a cure-all for potato maladies. During 15 years past we have not once failed, by two or at least three applications of it, to carry our vigorous main crop varieties to full maturity practically free from disease. The following shows the gain as compared with the use of Paris green alone.

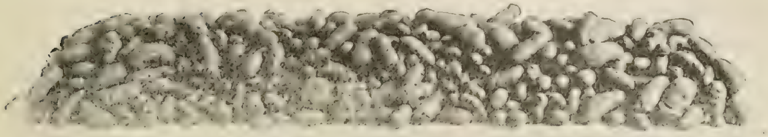
GAINS FROM THE USE OF BORDEAUX MIXTURE.

(Potatoes usually planted about the middle of May, sprayed in July and August.)

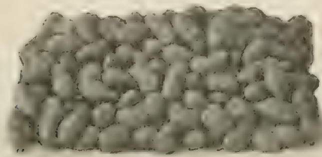
Variety.	No. sprayings.	Yield where sprayed.	Where not sprayed.	Gain.
White Star	2	313	248	65
White Star	3	291	99	192
White Star	3	338	114	224
White Star	3	323	251	72
White Star	3	389	219	170
Polaris	2	325	257	68
Polaris	3	151	80	71
White Star	2	238	112	126
Average 3 varieties	3	229	161	68
Delaware	2	285	225	60
Delaware	2	170	54	116
Delaware	2	298	164	134
Green Mt.	1	361	237	124
Delaware	2	327	193	134
Delaware	2	382	221	161
		295	176	119

This gain has in part come from checking the rot, but the important thing to note is that the greater portion of it is due to prolonging the healthy life of the leaves into the autumn as was shown by the earlier table on the time and rate of development. If even a single week is added to the vigorous life of the plants the gain will pay for the spraying, and if four weeks are added, as has resulted several times, the crop is doubled.

There are a number of practical questions yet unanswered. Space does not permit their discussion in detail. We will merely summarize our conclusions regarding them.



Total yield of marketable potatoes from 2 rows sprayed.



Total yield marketable potatoes from 2 rows not sprayed.

SPRAYED. NOT SPRAYED.

FIGURE 5. Showing the benefit of spraying with Bordeaux mixture in preventing the late blight. The rows at the left were sprayed three times. Photographed Sept. 10.

First—As to relation of date of digging to rot, the conclusions reached in our experiments are that, if rot is feared, it is better to delay digging until some ten days or more after the tops are

dead unless the soil is very wet, when early digging may be advisable.

Second—As to sprinkling lime or other disinfectant over the stored potatoes, our trials have failed to show any lessening of the rot by this practice.

Third—Prompt drying of the tubers and storage at as low a temperature as is practicable are both of importance in holding the rot in check.

In conclusion I wish merely to direct attention to another matter than spraying. That is, the need of more interest in the question of the relative resistance of varieties of potatoes. In this respect lessons may be learned from the European potato specialists. In America we commonly ask only about yield and quality when selecting varieties of seed potatoes. To these the Europeans always add a third question—as to disease resistance. They have found that some varieties are far more liable to disease than others. We know that too, only we have not as carefully discriminated and catalogued them. Also, they find that the disease resistance of even their best varieties decreases with age, so they are paying their breeders large prices for the most promising new varieties from year to year and they quickly determine the relative resistance of each new variety offered. Here we lose the best half of the possible life of a variety before we prove its merits or admit it into general culture. There the demand for disease resisting varieties is so clearly defined that certain potato breeders have established national and international reputations simply because of their success in this one line. We need to offer a like measure of appreciation to those of our own potato breeders who will render us a like service.

Finally, there they find that there is much difference as to disease resistance even with the same variety depending upon the place of growing and the method of handling the crop and the seed, northern grown seed being everywhere demanded as more vigorous and disease resisting. Maine's rapidly increasing reputation as a seed potato growing State is evidence that this country is more and more awakening to the importance of using only the most vigorous northern grown seed. But I trust that Maine growers, and those of northern New Hampshire and Vermont also, will soon be copying the methods of the Scotch

potato specialists and each vying with the other in proclaiming and proving the disease resistant merits of their special strains or varieties of potatoes. In so doing they will not only add to their already good reputation and to the profits from their business, but they will be conferring a material benefit on potato growers generally.

THE SCIENCE OF FEEDING ANIMALS.

By. Prof. F. S. Cooley, Amherst, Mass.

IMPORTANCE.

Of the four billions of dollars of our agricultural products in America, not far from two-thirds are concerned in the feeding of domestic live stock. The meat product alone is worth a billion a year; the cow, $600,000,000; hay and dairy, $500,000,000 each. Here we have enumerated nearly three billions of products, the result of feeding or of the materials to feed; and by going more into detail, including minor products and the poultry industry, we should realize that we had underestimated the importance of feeding among the branches of husbandry. It appears that the proper use of feeds is of even greater consequence than their production.

SOURCE OF FEEDING SCIENCE.

Most of what may be termed the science of feeding has been worked out during the last half century. Before that, experience was the only guide to successful practice. Sometimes, it is true, there was the cumulative experience of the father and grandfather, perhaps for several generations, to assist the feeder in the perfect points of his art. This experience did not afford the explanation of many circumstances deduced and results observed, and erroneous views often resulted from the lack of real scientific information upon the subject.

With the advent of applied chemistry, however, agriculture became better understood. It became possible to properly connect cause and effect, and helped to place practices upon a sound and rational basis. Animal feeding is particularly indebted to chemistry for the true explanation of many of its results. Ani-

mal physiology and bacteriology have also contributed to the science of feeding, as also have unclassified scientific studies of peculiar interest to this particular branch. Wolff and Lehman and Armsby and others have marked the last few decades as of exceeding importance in scientific studies of animal nutrition.

WHY DISCUSS SCIENTIFIC FEEDING WITH FARMERS.

A great deal is being published at the present time in relation to feeding, by experiment stations, departments of agriculture, and the agricultural press that would have been so poorly understood a decade or two ago by farmers as to be of no interest or value to them. Times are rapidly changing. Farmers now discuss familiarly feeding terms, e. g., protein, carbohydrates, standards, nutritive ratio, digestibility, etc., that would have then been utterly unintelligible. It is to still further increase this understanding of scientific publications that we pause to discuss the scientific side of this great industry. To enable the farmer to comprehend the publications pertaining to his art is an important work, and a few minutes devoted to the discussion of some of the more abstract principles of feeding will be better appreciated when we consider the mine of scientific information thereby made more available.

ANALOGY BETWEEN PLANTS AND ANIMALS.

There is a close analogy between plant feeding and animal feeding. As we have become familiar with the use of three essential elements of fertility and plant food in soils, viz., nitrogen, potash and phosphoric acid, we may consider that the animal organism also requires three kinds of feeding matter in order to become perfectly developed and profitable. While plants are able to feed upon the simple compounds existing in the soil and the air, animals need more complex food supplies as are produced by the processes of vegetation. The three classes of nutrients recognized in feeding animals are protein, carbohydrates and fat. Water is of equal importance to both plant and animal life, but while with the plant we pay particular attention to the important mineral nutrients and practically ignore the carbon which is supplied by the air, in feeding animals we relegate the mineral constituents to the background

and supply the nutrients which contain carbon as a most essential ingredient. The mineral constituents of plants and animals are identical; but if the plant has the requisite mineral foods the carbon takes care of itself, while the animal secures all of its mineral nutrients as an incident along with the more important organic substances.

DIGESTIBILITY.

The value and nutritive effect of any given fodder is not determined by its composition alone or the percentages of protein, carbohydrates and fat it contains; but rather by that part only which the animal digests. In considering the usefulness of any feeding substance, therefore, the digestibility deserves careful notice. It is interesting to observe how the digestibility of foods is determined, for it promotes confidence in scientific results to understand the processes by which these results have been obtained. In the first place we must know that digestibility cannot be ascertained in the laboratory by chemical reagents, acids, alkalies and such. But in order to learn to what extent an animal can digest the nutrients of a fodder we must put the question to the animal directly. Laboratory reagents and conditions cannot be made exactly like those of the digestive tract of the animal, so that if we relied upon the former, errors would be sure to be considerable. In studying digestibility with the animal we first prepare the system by a period of preliminary feeding for about a week in order to get the system accustomed to the fodder in question, and allow the previous fodder to pass off. Then for a stated period all the nutrients in the fodder consumed are carefully determined chemically and the same processes followed with the dung or solid excrement. The differences between the protein, fat, extract matter and fibre consumed in the food and that voided in the dung represent the portions digested. The percentage digestibility of each nutrient is determined by dividing the portion digested by the amount of that nutrient eaten. The percentage thus obtained is called the co-efficient. The digestion co-efficients for protein vary between 40 and 80 ordinarily, and may be said to approximate 70 on the average. It will be readily seen that it is of vast importance whether a fodder has a high or a low digestibility. One fodder might easily be worth nearly double another of the same material if the digestibility was nearly twice as great.

A practical side of the question of digestibility is brought out by a glance at the conditions which affect the digestibility of fodders.

EARLY VS. LATE CUTTING CLOVER.

It has been found by experiment that the digestibility of the protein in clover cut at different periods may vary as much as 25 per cent. Very early cut clover may have a digestibility of nearly 80 per cent for its protein while late cut may be as low as 55 per cent. If we take into consideration the fact that the early cut fodder is richer in its composition we may compute that one ton of early cut clover with 20 per cent protein, 80 per cent of which is digestible, furnishes as much of that nutrient as 2¼ tons of late cut clover of 13 per cent protein and 55 per cent digestible. The same rule holds with grasses used for hay or grazed off or fed green, and a slight reduction in yield due to early cutting is often well compensated by the higher digestibility of the early cut fodder.

The amount eaten has very little effect on digestibility. Animals will digest proportionally as well if fed up to full capacity as when fed half as much. Economy of production generally favors working animals on full time.

Drying in itself does not alter digestibility, but drying grasses or clovers may result in mechanical losses of the richer portions, and hence reduce digestibility. The dried product in this case would not be quite the same as the fresh grass.

Cooking does not improve digestibility. The various expedients in preparing fodders, cutting, soaking, steaming or cooking do not increase their percentage of digestibility although they may improve their palatability, increase the amount eaten and cause profitable results in feeding.

There are many other circumstances that may be considered in their relation to digestibility, but our brief time makes it advisable to mention only one more, viz., *the addition of starch.* Some very interesting trials by Stohmann, Henneberg and Wolff show a marked decrease in the percentage digestibility of protein and sometimes of the fibre as well, when a large increase of starch was added to the ration. To get the most complete digestion it appears that there must be a certain ratio between the nutrients fed. If we feed an excess of protein above the requirements of the animal, protein consumption increases and

waste results. If we feed too much starch there is a depressed digestibility entailed that may render a part of the starch worse than useless. To apply this lesson in practices, we should properly combine our fodders so as to give a balance to the nutrients. A large disproportion of starchy feeds like potatoes and roots should be avoided, and when these are fed they should be used in conjunction with protein feeds.

MANURIAL VALUE OF EXCRETA.

It should be borne in mind that the excreta of animals vary in manurial constituents with the fodders consumed. If these are rich in protein, the manure contains a higher percentage of nitrogen than where more starchy feeds predominate. It has been the custom of feeding experts to reckon 80 per cent of the fertilizing ingredients in feeds as recovered in the excreta of the animals. The character of live stock affects this, for growing and milking animals take out more than store or fattening stock. The proportion of fertilizing matter recovered in the manure, when this is well managed, will rarely fall below 80 per cent. When such concentrates as cottonseed meal are fed the manure has a value equal to half or two-thirds the cost of the feed, and in some localities cottonseed meal is applied directly to the land as a fertilizer. Clovers, also, enrich the manure. The wise feeder will seek to improve the farm by producing roughage and purchasing concentrates with an eye to the improvement of his land as well as the products of his flocks and herds.

Another observation here may be of benefit to us in teaching the requirements of our soils from the history of their previous treatment. The dung contains the insoluble portion of the fertilizer elements, including nearly all the phosphoric acid and half the nitrogen. The urine contains all the potash and the more soluble portion of the nitrogen. If now the liquid part of the manure filters through poor stable floors into the ground beneath the stable, or if, thrown out under the eaves, it is allowed to wash away with rains, it becomes impoverished by the loss of its potash and its soluble nitrogen, and our soils gradually become deficient in these substances when dependent upon such manure for renovation.

Nutritive ratio is a term used to designate the ratio between the protein in a food and the carbohydrates and fat combined. It is usually expressed with the protein as one, and the other nutrients in their proportion to unity. A common nutritive ratio for milch cows is 1 : 5 or 1 : 6. If it were 1 : 9 we should call it wide, or if 1 : 3 we should say it was narrow.

FUNCTIONS OF NUTRIENTS.

Protein:

a. Protein and protein alone forms flesh, albuminoids in milk and nitrogenous tissues.

b. Protein forms fat, as shown by many experiments and tests.

c. Protein produces heat to keep up body temperature.

d. Protein furnishes energy for muscular exertion.

e. Protein is a milk stimulant.

Protein alone can sustain life indefinitely. No other nutrient alone can do this.

Fat:

a. Fat is a source of fatty tissue.

b. Fat supplies body heat.

c. Fat is productive of muscular energy.

d. Fat protects protein from oxidation.

Carbohydrates:

a. Carbohydrates supply heat.

b. Carbohydrates furnish energy for muscular exertion.

c. Carbohydrates protect protein from undue oxidation.

d. Carbohydrates are believed under some circumstances to form body fat.

It is important that the feeder provide enough protein to secure the desired product, but having furnished enough, the body temperature and vital processes can be most economically maintained with less costly carbonaceous feeds.

Feeding Standards are statements of the amounts of digestible protein, carbohydrates and fat which experience has shown to be best adapted to a given purpose. They are deduced from actual trials with various combinations of fodders of known digestibility and composition. By beginning at one extreme and trying all sorts of proportions from that to the other a point between the two is found where the product is produced at the

lowest cost per unit. This point is where the standard is fixed. There are standards for growing animals, for fattening, for work and for milk.

The Wolff-Lehmann standard for milch cows was 2½ pounds digestible protein and 13½ digestible carbohydrates and fat; and any combination of fodders from which a cow could digest these amounts of nutrients was deemed satisfactory.

Feeding standards must be somewhat elastic, for obviously a cow giving four quarts of milk does not require the same feed as one producing twenty quarts. A sliding scale of standards for milk has been arranged according to the amount produced. Again, as the standard depends upon economical production, it follows that in a locality where protein is expensive and carbohydrates cheap the nutritive ratio will be wider than where the reverse is true.

Rations are combinations of fodders that are calculated to give a profitable yield of the product for which the animals are kept. These may be worked out scientifically upon a feeding standard. The best practice is to depend mainly upon home grown forage, and make this as complete as is profitable to do. By growing clovers, and cutting early, endeavor to make the home grown protein as much as possible.

The purchase of feeds should be supplementary in their character. They should not usually exceed one-fourth to one-third of the ration, and should be purchased with an eye to providing the nutrients lacking in the home grown fodders at the lowest cost.

ECONOMICAL FEEDING OF ANIMALS.

By Dr. H. P. MILLER, Sunbury, Ohio.

The economical feeding of animals involves the consideration of several factors; the animal, the conditions under which it is fed, the purpose for which it is fed, and the feed. The first two factors can only here be mentioned. The second depends upon the fact that the tissues and other animal products desired from the feeding of animals call for different substances, called nutritive elements. A nutritive element is a substance which furnishes, upon being consumed by an animal, the material for the production of one or more of the things desired, as muscular tissue, fatty tissue, milk, or some other animal product. The explanation of why our fathers and many of us have fed animals with some degree of profit without understanding how foods were utilized in the body, or anything regarding the selection of suitable feeds, depends upon the fact that all of the feeding stuffs ever utilized contain some of all of the nutritive elements required. The necessity for a more careful study of the feeding problem depends upon the fact that very few of the feeding stuffs contain the nutritive elements in the right relative amounts for best results; and also upon the fact that animals fed for different purposes require different amounts and different proportions of these nutritive elements.

Now to explain what is meant by a nutritive element; call to mind that you have sometime taken a small handful of wheat, placing it in the mouth to chew. After the wheat grains are ground and mixed with saliva, the quantity diminishes and the consistency changes. What has actually taken place is that the starch grains of the wheat have been dissolved by the saliva and swallowed with it. The somewhat pasty, tenacious mass that remains in the mouth and does not dissolve or disappear no matter how long it is mixed with the saliva is the gluten of the wheat grain, being a different chemical substance and producing different elements in the animal body when eaten. Now, to understand the use of these nutritive elements still farther, I will cite that the chemist makes a further separation of the

starch, which is representative of the class of nutritive elements called carbohydrates, into its chemical elements, finding that it contains carbon, hydrogen and oxygen; hence the name, carbohydrates.

There are other substances similar in chemical composition grouped with this in the class called carbohydrates. The principal ones are sugar and gum. Vegetable oil, called fat, also contains the same chemical elements, but in different proportions. Having more carbon, it is more valuable pound for pound, hence is usually given as a separate element in the analysis of feeding stuffs, but when eaten by animals it serves the same purposes as the carbohydrates, hence is classed with them.

This group of nutritive elements when eaten by animals serves one or more of three purposes. The first demand is to supply the heat of the animal body. For this carbon is burned after being digested and assimilated and coming into contact with the oxygen in the lungs in a very similar way to which carbon is burned in any of the fuels we use for heating our homes. This demand upon the food is variable, just as the demand for fuel for heating a stove is variable, depending upon the conditions under which either the animal or the stove is placed. And here is the value of this rather technical discussion of the uses of food. An animal exposed to low degrees of temperature and high winds uses a much larger proportion of its food to keep its body warm than an animal that is comfortably housed. This explains why taking two animals equally well bred, in equal degrees of health, of equal age, differing only in condition, and placing them in an open yard in the winter and feeding them exactly the same kinds and amounts of food, the poor animal will become poorer and the fat animal become fatter.

The second use to which this carbonaceous food, or carbohydrates, is put is in the production of working energy or power. Thus we see why it is that a working horse requires more food than an idle one.

The third way in which this class of nutrients is utilized is in the production of fatty tissue, fat not being produced until the other two demands are met. We understand why it is that it is more difficult to fatten an animal in winter than in summer,

and why it is all but impossible to fatten a hard working animal. Note that this explains the production of fatty tissues only. The explanation is that the carbohydrates do not contain all of the chemical elements necessary for the production of muscular tissue and other similar tissues, as the nervous, connective tissue, the integument and its covering, as wool, hair, feathers, etc. For the production of these tissues the animal requires the nutritive element termed protein, a type of which is the gluten separated from the wheat in a similar manner to that mentioned in the illustration. Similar products are found in practically all of the feeding stuffs ever employed.

The next question the feeder asks is how we are to find these different nutritive elements. The farmer is not supposed to make the analysis for himself. That has been done and the results published in bulletins that are in reach of every one. The various experiment stations, and the Department of Agriculture at Washington have issued bulletins that can be had for the asking, giving the nutritive elements in practically all of the feeding stuffs ever employed.

The feeder then asks: In what proportion do our animals want these different nutritive elements? For the answer to this we must not turn to the chemist but the animal itself, or rather, to recorded results gotten by asking the animals. To illustrate: A one thousand pound steer was placed in a comfortable stable, his food and his water being carried to him so that he was not expending any large amount of energy, or using any large amount of food in producing heat. Known amounts of the different nutritive elements were fed him until it was found out just how much of each it required to maintain him at one thousand pounds weight for twenty-four hours time. That is, the maintenance ration was found, the result being that he required about seven-tenths of a pound of protein and ten times that amount of carbohydrates and fats. The question was next put to a cow of the same weight giving twenty-five pounds of milk every twenty-four hours of time. The result, as would readily be guessed, was that the cow required more food, the food being required for the production of milk, but a simple increase in feeds of the same kind was not satisfactory. The cow wanted a greater increase in the protein, the result being

that she wanted about three times as much protein material but not ten times that amount of the fat producing material, only six times as much; so that, as it is expressed, the cow wanted a nutritive ratio of 1 : 6.

Now the question that presents itself is: Where are we to get feeds with these nutritive ratios, or how may we combine feeds so as to produce them?

Digestible Nutrients. Pounds Per ton.

	Protein.	Carbohydrates.	Fat.	Nutrative Ratio.
Corn silage	18	226	14	1:14.4
Timothy hay	56	868	28	1:16.7
Clover hay	36	716	34	1:5.9
Alfalfa hay	220	792	24	1:3.9
Corn grain	158	1,334	86	1:9.7
Oats grain	184	946	84	1:6.2
Wheat bran	244	784	59	1:3.8
Gluten meal	516	866	220	1:2.7
Cottonseed meal	744	338	244	1:1.2
Linseed oil meal O. P	586	654	140	1:1.7
Soy Beans	592	446	288	1:1.9

Referring to the chart, we see that corn silage (which means the entire corn plant) has a nutritive value of 1:14. By this we mean that there is 14 times as much material in the entire corn plant which goes to produce heat, energy and fat as there is of the material used to produce muscle and the allied tissues, or milk in feeding the cow. Now recall that the cow wanted a nutritive ratio of 1 : 6. Hence it is seen that in feeding the entire corn plant we feed a great excess of the carbohydrates or fat producing material. In order to enable the cow to utilize all of the fat producing material in the corn plant we must feed something that contains a relatively large amount of the protein material in order to get the right proportion of the two nutritive elements. Glancing at timothy hay, which seems to be the most nearly universal feed in Maine, we notice that it has a still wider nutritive ration, 1:16. Hence this calls for a larger supplement of the rich protein feed. Glance at the nutrients in clover hay. Here we see that the striking contrast between the two hays lies in the relatively large amount of protein material, giving a nutritive ratio of approximately 1 : 6, just what it was found the cow needed for milk production. You may ask the question: Then why not feed clover hay alone? The answer is to be found in noting that the combined nutrients in clover hay are less than

one thousand pounds; that is, more than one half of the clover hay is material from which the animal gets no value. In a word, the cow cannot eat enough clover hay to get digestible material enough to enable her to give her full possibilities in milk production.

Note that alfalfa has a still larger amount of protein, giving it a much narrower nutritive ratio; narrower, in fact, than the cow wants. So that it may be fed as a supplementary feed with corn silage or timothy hay. However, it is still open to the objection of having a considerable proportion of indigestible fiber, so the search for supplementary feed for timothy hay cannot rest here. It means that some concentrate, as a whole grain or a grain product, must be used. First examine corn. We note that adding all of the digestible nutrients it contains more than any other feeding stuff mentioned, but has a nutritive ratio of 1:10, which is again too wide for the cow. Oats it will be noted contain more protein and less of the carbohydrates and fat, giving it a nutritive ratio of 1 : 6, just what the cow said she wanted. Here it may be noted that all young growing animals need just about the same feed as the cow producing milk, and in these two facts we have the explanation of why oats is a better grain for colts, calves and lambs than corn. It is not that they contain anything the corn does not, or that corn contains anything that oats does not, but that the proportion of the nutrients is right in the oats for the cow and the young growing animals. It will be noted that clover hay and oats, both being rich in protein, may be combined so as to make the perfect ration for the cow, and that is true. The only reason the discussion does not rest here is that we have not provided any substitute for either silage or timothy hay for cow feeding, hence the search must go farther. Wheat bran, which corresponds somewhat closely to your mixed feeds, contains a still larger amount of protein and a smaller amount of the carbohydrates, giving it a nutritive ratio of about 1:4. This explains why you get good results in feeding this with either corn or timothy hay. Another question here arises, as to whether this is the cheapest source of protein. Note there are several other feeds containing much larger amounts of protein, as gluten feed, cottonseed and linseed meals. The question then arises, are these other feeds of

greater value in proportion to their greater content of protein? In other words, is gluten feed, containing approximately twice as much protein as the wheat feed, worth twice as much? Prof. Henry, an acknowledged authority upon feeding questions, says that so far as known at the present time one source of protein is as valuable as another. In my own feeding operations I have acted upon this statement and years ago discontinued the feeding of wheat bran when the price went to $16 a ton. I have since bought the feed that furnished me protein at the least cost per pound, with apparent good results. This consideration, however, is to be noted, that cottonseed meal is not so valuable to feed with timothy hay as with corn silage, owing to its dietetic effect; of linseed meal the reverse is true. Hence linseed meal is better than cottonseed to feed with timothy, cottonseed better to feed with silage. Another factor enters here also. Some animals do not like one meal as well as another and the careful feeder will consider the likes of his animals. But as to the question of cost, note that your wheat feeds, containing 240 pounds of protein per ton, when costing you $24 per ton make each pound of protein cost ten cents. Cottonseed meal at $35 per ton makes it cost less than 5 cents per pound. Now that you may understand how to determine the relative values of any feeds, bear in mind that your State laws require the labelling of every sack of feed sold in the State with a statement of the per cent of protein and the per cent of fat. For your purpose you need consider for the present only the per cent of protein. This means the number of pounds of protein in each hundred; that is, cottonseed meal containing 42 per cent of protein contains 42 pounds of protein in each hundred pounds. So with other feeds. Now to find what each pound of protein costs, divide the price per ton by the number of pounds of protein in each ton. That will give the cost for each pound of protein.

Here another factor must be noted. I have already called attention to the fact that the hays contain a relatively large amount of crude fiber, which is indigestible, hence worthless as food material. In any commercial feeding stuff having a small per cent of protein and fat, there is necessarily a relatively large amount of crude fiber or worthless material; hence a cottonseed meal containing 21 per cent of protein is not worth

half as much as one containing 42 per cent, as might appear upon the face, the reason being that the 21 per cent meal has a very high per cent of crude fiber that must be passed through the alimentary tract and calls for a considerable expenditure of energy in thus handling it. So that the reserve gotten from the low grade goods is correspondingly small. Here the general statement might be made, as has appeared by investigations we have made at various points in the State, that high grade goods always furnish the nutrients at less cost than low grade goods.

As to the specific directions for feeding cows, this is to be said: No two cows require exactly the same amounts of feed. The amounts should vary with the amount of milk the cow is giving, and for each individual cow should be determined by the amount for which she will pay. That is, each cow should be fed up to the limit for which she will give an increased flow of milk. I avoid saying that just so many quarts of oats or wheat feed or cottonseed meal should be given, because not all dairymen will have any single feed that might be mentioned, and as we have tried to show, it is not necessary that any particular kinds of feed be used; the important thing being that sufficient, and the right proportions, of the nutritive elements be supplied, each feeder providing them in the form that is most convenient and economical.

The entire discussion thus far has been in search of a feed rich in protein to supplement feeds rich in carbohydrates. There is a single instance in our feeding operations where the reverse must be done. That is in the feeding of skimmed milk to pigs or calves. The fat has been removed and the nutritive elements that remain are very largely proteins, giving skimmed milk a very narrow nutritive ratio. Hence the proper supplementary feed for it is one rich in carbohydrates and fat. This we find in corn; hence the practice upon my own farm of feeding shelled corn to pigs and calves in connection with skimmed milk. Prof. Henry found best results were obtained by feeding one pound of corn with not to exceed five pounds of milk, for young pigs. With calves eating some hay the proportion of milk may be slightly greater than this. We have not found it any advantage to grind the corn for either pigs or calves. They digest it completely. There is a real advantage in feeding it dry and in

condition in which it must be thoroughly masticated, in that the saliva thus secreted is necessary for complete digestion of the starch. It is really a very great waste of the most valuable and costly nutrient to feed skimmed milk alone, and many instances of its proving detrimental to pigs are on record.

Because of the increasing cost of protein in all commercial feeding stuffs I am attempting to produce the needed protein through the soy bean which, it will be noted, contains practically the same amount of protein as linseed meal, giving an extremely narrow nutritive ratio. The crop promises to be a profitable one so long as these commercial feeds remain as high as they are. The only obstacle to their becoming a regular crop upon every farm needing additional protein to feed supplementary to corn and timothy hay is the difficulty in harvesting them. It is to be noted that the man who relies upon timothy as a hay or fodder crop may greatly improve it by cutting early, early cut timothy having fully 50 per cent more protein per ton than late cut timothy. The same is true of mixed hays, even clover, ripe clover losing much of its leaves which contain a large proportion of digestible protein.

THE CARE AND MANAGEMENT OF THE DAIRY HERD.

By C. D. Smith, Director Michigan Experiment Station.

This topic is too broad to be covered in one address at an institute. The particular phase of it to which we are to devote our attention for the next half hour is the sanitary conditions of the stable. Before beginning this phase, comment upon some things which Dr. Miller has said is called for. In the first place, note the difference between early cut and late cut timothy hay. Early cut hay, per hundred pounds, is worth much more, almost 50% more than late cut timothy hay. The moral is obvious, namely to cut the hay before the sugar and the starch shall have been converted into wood.

Note again the value of clover hay as compared with timothy. Maine farmers could scarcely afford to grow timothy hay, to feed to cows, on lands where clover will do well. I am not inveighing against growing timothy hay if the markets are such as to warrant it. Timothy hay does not exhaust the soil as some of the people who darken counsel by multitude of words in the newspapers would have you believe. I must speak of this subject of soil exhaustion a little later in this talk. It is all right to raise timothy hay as one factor in a ration, it is all right to sell the hay when you can get $20.00 or $25.00 per ton for it. The land is your bank and when you can make good use of its content of plant food you can rightly do so. But timothy hay is not good feed for the dairy cow as compared with either clover hay or alfalfa. Timothy has surface feeding roots and clover has tap roots. The timothy field is accumulating humus and although the mineral resources of the soil are drawn upon to supply the rapidly growing grass, it is none the less true that the field is growing richer in humus while the timothy crop has possession of the soil. Humus, or rather rapidly decaying vegetable matter, is important to the soil in two ways; it increases the water holding capacity very materially by making the soil spongy and by making the soil solution rich in nutrients. Again, the decaying of this vegetable matter in the soil aids in setting free the plant food tied up in insoluble form in the soil itself.

The Maine soils coming from the disintegration of the rock in place of from the grinding of the glacier, contain enough plant food in themselves to last for a great many years. Luckily this plant food is tied up so that the present generation cannot get it. It is hard work to secure enough of it to supply the wants of a growing crop, and it is quite impossible to get it in such excess as to rapidly wear out the soil. The use of barnyard manure or the plowing under of green crops aids the soil by furnishing through decay, a large amount of carbonic acid gas, which uniting with the water in the soil, gives an active acid which in turn acts upon the insoluble phosphates making a small per cent of them soluble in water and thus available to plants.

The clover has one advantage over the timothy, its roots furnish a larger gross amount of this decaying organic matter than do the roots of timothy. On a certain occasion I took an aliquot part of an acre in a clover field giving about 1½ tons of hay per acre, removed the crop to where the mower knives would have cut off the plants, then washed out the soil to a good depth, applying a stream of water under heavy pressure. The roots in the upper 10 in. of soil were taken out, weighed and analyzed. It surprised us greatly to find that they contained as much plant food as would be supplied by at least ten loads of barnyard manure per acre. Moreover, this plant food in the case of the clover roots was disseminated through the soil, not in layers as is done when barnyard manure is applied, but scattered all through the soil, nicely mixed with the soil and ready to decay during the hot months of July and August to furnish plant food to the growing corn crop just when that crop needs it most. There is nothing to be said against commercial fertilizer. It is a good thing to use to supplement barnyard manure but it furnishes a great bulk of available plant food when the crop is small and unable to utilize it, whereas the decaying clover furnishes the plant food to the corn crop just at the period of most rapid growth. Again, a large part of the nitrogen stored up in these clover roots is obtained primarily from the air by the bacteria working in the nodules on the roots. By digging down four feet and examining the roots of the clover at that depth, we found that they were engaged in bringing up potash and phosphoric acid from the zone below the depth of the roots of the cereals. Whatever plant food there was stored

up in the decaying roots of the clover plants near the surface, was a contribution, a free gift of the clover plant to the soil. It is right, therefore, that the farmers of Maine and all other farmers should regard the clover plant and its cousins as the backbone of their agriculture. They are the one class of crops that give abundant forage and at the same time leave the soil richer for having borne them.

Turning now to the grain feeds mentioned by Dr. Miller, this comment is called for. His theory of the balanced ration is eminently correct, with one or two qualifications. In the first place the digestive coefficients may not tell all the truth concerning the feeding stuff. Suppose we had corn meal and found it to be 80% digestible as to its protein content. Suppose we should add to that corn meal, oat hulls, the digestibility as far as the table would show, would not be greatly depressed but the nutritive effect of the food would be greatly reduced. Remember that, as far as oat hulls are concerned, it takes more energy to digest them than they themselves contain. The same thing is true of coarse corn stalks. The chemist finds a great deal of food value in coarse corn stalks but let us remember that while the cow finds that same amount of plant food in these stalks, she also finds that it costs more energy to digest them than the ingredients in the corn stalks are really worth. Be careful, therefore, in buying your grain feeds from the west that you do not buy these oat hulls or these mixed feeds containing oat hulls. Buy cottonseed meal, linseed meal, wheat bran, but fight very shy of the by-products of the oat meal factories or of those other mixed feeds diluted with oat hulls.

When you buy these commercial feeds always use the table which Dr. Miller has given you but buy such feeds as will furnish you the protein most cheaply.

I cannot go on with my regular topic until I have said something to you about the selection of cows. Since I have been in Maine I have listened with a great deal of instruction and pleasure to the talks of certain gentlemen who believe that cows can be separated into the profitable and the unprofitable animals by the eye applied to the outward form.

In other words, these gentlemen believe that the form of the cow indicates with approximate accuracy the value of the cow

in the dairy. It is true that when you and I go out to buy cows we cannot take a Babcock test and a scale under one arm and a tuberculin syringe under the other. We must be governed by our eyes. For the initial purchase this method is all right but as soon as these eye servants have been brought into our barns we must weigh and test the milk. This is the supreme court from which there is no appeal. Performance must support form or form must give way to performance. It is almost useless for any institute speaker to urge the importance of cow selection but we must keep at it line upon line, precept upon precept, hoping for evolution not for revolution. It is useless to bring up my own case where in establishing a herd of sixty-five paying animals, we found it necessary to buy over 140 cows, measuring them with the scales and the crude test and rejecting all those who did not give a sufficient yield of milk to give us a profit on the feed consumed and the time expended in their care. It is perhaps useless to call the attention of this audience to the fact that the prettiest cow we had, a cow purchased of a Mrs. Camp, yielded but about 2250 lbs. milk in the year, although when she was fresh she gave as high as 40 lbs. of milk per day. Her form approximated the standard but her performance was nil. She was fattened and sold to the butcher. While another cow called Slope, a homely old creature, gave us 7000 lbs. milk and this although in many respects she varied widely from the empirical standard. It is useless for us to discuss the well known fact that in the stables of possibly every farmer who does not weigh the milk of each cow, one half of his herd produce all of the profit and he would be better off if the other half were banished from his stables altogether. Select your cows, therefore, not by breed alone, except to take the breed you like the best and stick to it, but make your final selection by the scales and tests. It is a bother, it does take time but it pays. In fact, no dairyman can expect to get much profit from his dairy until he has selected out the cows that do not pay.

Now with properly selected cows and wisely bought feed we are ready to take up the question of the stable sanitation.

As our cows approach the stable they must not be required to wade through mire and mud. In their pasture fields they must be excluded from mud holes. The work of Dr. V. A.

Moore, Cornell University, has shown that where cows waded through filth deep enough to besmear their udders, no matter how thoroughly washed these organs may be, the milk ducts and the milk cisterns will contain the bacteria derived from this mud and will retain them in sufficient quantity to spoil the milk for perhaps two days afterwards. The stable should, therefore, be located upon such a rise of ground as will permit thorough drainage in the vicinity and avoid mud holes. In making a study of the milk supply of Boston recently, I found in Massachusetts some barns where this matter was utterly neglected. Cows had to wade through small lakes of filth and the milk from that herd could not be pure.

As we cross the threshold of the stable door, we step upon the floor. In all barns on the very basement, this floor may well be made of cement because so easily washed and kept clean. Naturally where the location of the barn and the method of farming demand the basement for manure storage, the floor must be of wood. This means more care in keeping the floor clean and swept. The stable floor should not be level, the platform on which the cows stand should be raised higher than the gutter upon that floor. To produce pure milk, sanitary milk, the cow must be forced to keep herself clean. She must be prevented from soiling herself with her own droppings. This means that she must lie upon a platform, her droppings falling into a gutter behind that platform. This gutter should not be over 8 inches deep although the width may be made to suit the convenience of the owner and the amount of space available in the stable.

How the cow shall be fastened is the next question. Our rule in Michigan leads me to recommend the Model stall described by Governor Hoard. It is a cumbersome stall but a very convenient one for a man who has but few cows. It will keep the animals spotlessly clean. So will other kinds of stalls like the Bidwell stall made and patented by Porter Bidwell, McGregor, Ia. Also a kind of stall found in the barn of the Commissioner of Agriculture in this State, Hon. A. W. Gilman, of Foxcroft. In this stall a fence prevented the animal from stepping too far forward while the shortness of the tie prevented movement too far in the rear. There was perfect freedom of

turning the head and the ease and convenience of feeding was not interfered with. The swinging stanchion, and the Newton cattle tie are both good. It is not for me to say which is the best. The essential thing is to avoid very much forward and backward movement, thus preventing the cow from lying in her own droppings.

The side walls of the stable should be such as to exclude the cold without preventing the introduction of abundant sunshine. Sunshine is nature's great disinfectant. It is the germ destroyer. Where, at one station an examination was made of the sputum, the spittle, of a consumptive patient, where for many times half was dried in the sunshine and the other half in the shade, it was found that the sun had killed the germs drying in the sunlight while the germs drying in the middle of the room out of the sunshine would give the disease to the guinea pigs under whose skin they were inoculated. In another case where a whole family had been killed by this white plague it was found that sunlight never entered the living room and the rug was a mass of tubercle bacilli. The worst of it is that when these germs dry they do not necessarily lose their vitality. If they dry in the shade they are quite apt to be borne in the air upon particles of dust and conveyed to the nostrils of human beings. I assume that it is undoubtedly a fact that nearly all of us have been consumptive at one period of our lives or another. Those of us who are strong, mature and healthy have in our blood little white corpuscles which seize upon these disease germs as soon as they cross the membrane into the body proper. They seize upon them, surround them and kill them. Sooner or later for most of us these white corpuscles will become too few or too exhausted, some disease, most likely consumption, possibly diphtheria, possibly typhoid fever, will gain entrance to our bodies, will develop there with startling rapidity and will cause the separation of the soul and body. In my opinion consumption gains access to the human body more often through the nose and lungs than through the mouth and stomach. It is not the milk of the cow which conveys the germ, in most cases, to the city infant. Usually these little children creeping about upon the floor of sunless houses breathe in the dust from the rug or the carpet, that dust being made up partly of the dried material from the lungs of

some consumptive patient who may or may not know that he has the disease. It is true, however, that consumption may be carried through the milk of the cow. It is our duty, therefore, those of us who supply milk for human consumption, to have our cows tested with the tuberculin test and to be very certain that we are sending from our farms a sample of milk absolutely free from the germs of tuberculosis. With the cows properly tested we should bathe them in sunlight every sunny day. It has been my pleasure to visit in Maine, barns where the cows are put along the south side and where the south side itself has one continuous window, letting in the sunlight, bathing the floor in sunlight, saturating the animals with the ex-ray and all other rays of the sun to drive away disease and to keep them healthy. I visited other barns where no sunlight was allowed to enter, just little holes in the wall through which the manure was pitched. These are an abomination. It is impossible to keep any barn sanitary where the floor is not bathed in sunshine each sunny day. So it is with our houses, the deadly day shade is almost as fatal as the deadly nightshade.

The walls of the barn should be smooth so that they can be whitewashed twice each year. The whitewashing should be done in that barn, but with a spray pump. Whitewash is cheaper than human labor hence a pail of liquid should be carried to the proper place, the necessary material put in it, and sprayed with a good deal of force against the walls and on the ceiling.

It of course follows that the ceiling shall be smooth, not rough boards laid a few inches apart supporting hay or straw above and letting the dust rattle through. It is true that pure milk can be made in a stable with such a ceiling but that is not the best way. If possible, cover over the top of the cow stable with a smooth ceiling. Whitewash it once or twice a year.

The daily program in the stable has much to do with the purity of the milk. It is assumed that if the air be kept pure, if dust be eliminated, and if foul odors be kept out of the stable at milking time the milk will be pure. It is not true that all milk, as it leaves the udder of the cow, is free from germs. The first milk to be drawn is seldom, if ever, absolutely free from bacteria. Many experiments have shown that the remainder of the mess, after the first few strippings are drawn, is almost

germ free. I have kept in my own office at room temperatures, a sample of milk thus drawn, for several weeks without souring or becoming loppered. The aim of the dairyman is therefore directed toward the exclusion of bacteria from the milk after it leaves the cow.

Where the stables are arranged as many of them are in Maine, the cows standing over the manure cellar, an arrangement clearly objectionable, from the standpoint of a western dairyman, it may be a good practice to clean out the stable the first thing in the morning, at once covering over the wet floor with sawdust. This operation must be done some time before milking that the bad odors may disappear. The cows should then be groomed, brushing the udders thoroughly, and the dust allowed to settle for at least a half hour before milking. The udders should then be dampened, just before the milking begins. The first quarter of a pint or such a matter from each cow should be milked into a pail, the contents of which are afterwards to be fed to pigs or otherwise disposed of, certainly not going into the city milk supply. If then the remainder of the milk is drawn into clean pails, it will not need to be pasteurized to keep, for any reasonable length of time, nor will it give rise to toxic poisons.

In carrying forward the method described we found it necessary to arrange a strap, fastened to the stanchions, to snap across the stall under the throat of the cow to prevent lying down after the udder has been cleaned. It was demonstrated also that where an hour could not elapse in the morning between cleaning the stable and brushing the cows and the milking, it was better to leave the stable uncleaned, covering the droppings with sawdust and to leave the cows without grooming other than brushing off the flanks and udder, stirring up as little dust as possible. It was found worse than nothing to brush the udders just as the milker sat down to his job, as the brushing simply filled the air with floating dust, each particle of which carried a myriad of germs. It seems unwarrantably complicated to demand that the dairyman shall keep the sides and flanks of his cows free from manure, shall brush the sides and udders, then wait for the dust to settle before milking; but there is no other road to perfect milk.

The pails should be spotlessly clean, bright, comparatively new, and always of metal. In making these pails, see that the tinsmith solders all the seams and creases so that there will be no sharp corners on the inside. Around the bottom where the sides join the bottom, is the place where the fault usually occurs. Get the tinsmith to run this acute angle full of solder, making the corners round and more easily washed.

The washing should be done in this wise: Rinse off the milk with tepid or cold water, then wash the tin in water too hot for the hand. Use a brush not a cloth, salsoda or some washing powder, not soap. After thoroughly scrubbing with the brush, rinse in boiling water, fresh from the spout of the teakettle, rinsing off all of the suds. Do not wipe but set at once in the sunlight for further disinfection. The straining of the milk may well be done through two or more thicknesses of cheesecloth, cut large enough to completely cover the top of an old fashioned conical strainer and fastened thereto either with four clothespins or with a rubber cord. As often as these strainers become soiled, put on clean ones. The cloths themselves should be washed in cool water then boiled every day.

The milk is removed from the stable as fast as milked, strained where the air is pure, then aerated and cooled. A little ingenuity will suggest ways of making proper milk rooms at small expense, convenient to the stable yet far enough away from the cows to avoid the odors and dirt.

In conclusion I must admit that so much is said against milk in the city, and the price of pure milk in a non-discriminating market is so low that there is little encouragement for the production of a first class article. Some city people are crazy to get things cheap, regardless of quality. On the other hand, as city people become better educated they are going to appreciate pure milk more and more and are going to be more and more willing to pay for it. Again, our creameries have been in the habit of taking in milk and cream regardless of purity, but they are learning that pure butter cannot be made from nasty milk. A campaign of sanitation is therefore in order. Cleanliness is no longer a matter of education, however, but of inspiration. It is your duty and mine to preach this gospel of cleanliness by example and by precept when we meet our neighbors and friends.

The world was not made in a day and we do not look for a complete revolution in method but we are rightly hoping that the day is not distant when all our cities will be supplied with a first class article of pure milk at a price which will be satisfactory to the farmer.

WHAT VARIETIES OF APPLE TREES TO PLANT.

By D. H. Knowlton, Farmington.

As people realize more and more the profit from Maine orchards, they are setting more trees. From all parts of the State information reaches us that this is going on, and there are frequent inquiries as to varieties. Now this matter of varieties is all important, for this alone may determine the profit in growing fruit. As it now goes, the variety is largely a matter of fancy with many, rather than of mature judgment. Years after the trees are set, these people find out to their sorrow that others are getting more profit from the orchard than they are. To be sure the trees may be worked over into some other varieties, but all this represents a loss to the owner which might have been avoided had he started right. In spite of all the advice given by the best fruit growers, the farmer seems always ready to listen to the smooth-tongued agent. He ignores those varieties that he knows his neighbors have found profitable, and instead sets something that pleases his fancy under the influence of the agent and his book of beautiful colored plates.

In what is known as the "apple belt" of the State the Baldwin has been the one variety that has succeeded best. It may be urged as an objection to it that one does not get a good tree from New York nursery stock without working over Talman Sweet or some other variety. The reason for this is not very well understood, but the fact is well known that Baldwin trees from the New York nurseries do not withstand the cold and many of them are killed back and oftentimes entirely killed. As evidence of the value of this variety, reference only is necessary to the many growers who are successfully growing Baldwins for market. Growers in the vicinity of Winthrop are

very successful in growing the Roxbury Russet, for which in the late spring they are quite sure of a fancy price in the Boston market. A year or two since I was in Winthrop when many of these apples were going forward and the fruit never appeared to better advantage. It was a fine yellow russet, of good size and excellent flavor. It is also an apple that sells well in the English markets. It certainly deserves a wider growth in the localities where it does well.

The Rhode Island Greening is another popular market variety, and it is also one of the best in quality. In the English market the price is fully up to the Baldwin. It makes a very good tree, and in the localities where it does well is a profitable variety to grow. It may need, as all others do for that matter, to be handled with care to get the best results. The Rhode Island Greening thrives over a large part of the State.

In many places the Baldwin does not thrive in the low lands, near streams and bodies of water, but the Northern Spy comes in and makes one of the best trees, and when it comes into bearing it is one of the most profitable apples grown in the State. Solon Chase, S. L. Merchant and others, with the careful handling they give them, get better prices for these than for any other variety. Several lots of these last year sold for $8 per barrel, and there was demand for more just like them. The objection to the tree is that it is slow in coming into bearing, but to some extent this can be overcome by cultivation.

In the sales account the Maine Ben Davis are higher than other Maine varieties in the foreign markets late in the season. A great many of this variety are growing in the State. They come into bearing earlier than some, and are attractive in appearance. These qualities would seem to make it a desirable apple to grow, but it is an apple of inferior quality, and it is the belief of many of our fruit growers that as soon as the foreign buyers learn more of the varieties there will be less demand for it. At any rate there is much hesitancy about recommending this or any variety, for setting, that is of inferior quality. In the minds of some the tree is believed to be one of short life. Experiments are being tried to determine whether it is a desirable variety to work over into other varieties.

The past two or three years a great many Stark have been set. The tree is a good grower, better than the Ben Davis, and the fruit is quite as attractive. It is a little better in quality also, but is not quite up to our best market apples.

The nursery people all the time are offering more or less new varieties with the hope of selling more trees. One of these that is being put upon the market at the present time is the Spencer Seedless apple and of this a few words may not be out of place. In a recent article written by Prof. S. W. Fletcher of the Michigan Agricultural College for the Rural New Yorker, he says he visited Mr. Spencer's home in Colorado. Mr. Spencer was not at home, but he found the hired man out in the stable sorting over some 25 bushels of Seedless apples. This fruit is of medium size, flattened and often one-sided. In the sun the fruit is dull red nearly over the entire surface, marked with many large whitish dots; in the shade it is the color of an Eastern Seek-No-Further. The color is good, but not nearly as bright as the color of the Jonathan, Gano and Winesap grown in the same locality.

In 25 or 30 apples cut open for examination over half of them contained from one to five shrunken seeds. Fully three-fourths of them had well-developed cores, with tough partitions like other apples. A large percentage of the apples were wormy, although the trees had been sprayed, and the hired man even admitted that it was more likely to be wormy than other varieties growing nearby. It is claimed that trees of this variety growing near others will have more or less seeds, as these examined certainly did have. On the other hand, if they are planted by themselves it is the claim of the grower that the fruit will be seedless, or nearly so.

In conclusion Prof. Fletcher says that so far as the tree is concerned it is all right, but that "the fruit itself does not possess the essential points of a profitable market variety." I am calling attention to this variety for the reason that agents are selling it in the State as a most desirable commercial apple for our people to grow.

Williams Favorite is an apple that is popular in the Boston market. It is an early variety, but one of our fruit growers sold his 1906 crop in that market at the rate of $1.25 to $2.25

per bushel box. He says of them that they are one of the most profitable he has in his orchard. He had somewhere about 200 boxes. This suggests that it is wise to have an eye all the time upon the home markets, as they are nearby and we are likely to be better served than when we ship across the water. So there are other varieties that mature early and are good sellers.

The question then comes home to the farmer, What varieties shall I plant? The answer I shall give to this question will not be definite, because I am not familiar with the surroundings, but the farmer who wishes to extend his orchard should take into account what apples do well in the locality. He should learn what these are and from them select the kinds that are the most desirable. Only a few of these have been named, but do not allow the man who comes along with a well-taught story to induce you to plant a novelty when a certainty stands out clearly before your face. There are enough of them, and when once the varieties are determined be sure to place the order with the most reliable dealers only. Insist on inspected stock to secure freedom from San Jose scale and other noxious insects. Examine the trees carefully when they arrive and if traces of insects are found do not plant the trees until a thorough examination can be made by the State entomologist. Set the trees carefully and give thorough cultivation and careful pruning, and the rapidity with which they will mature will surprise the grower.

SUGGESTIONS TO FRUIT GROWERS.

By C. D. SMITH, Director Michigan Experiment Station.

Maine strikes an observer from Michigan as an exceptionally good state for apple growing. In the first place you have such splendid sites. Maine farms are so beautiful that they are turned up on edge that people can see them better. The upper edge, when not bare rock, is just the place for an apple orchard.

Remember that Michigan orchards are threatened with at least one deadly enemy, the San Jose scale. I am sure that the most of the area of Maine is north of the danger line of this dire evil. All over the western part of Michigan are orchards which are neglected, or torn up by the roots because the San Jose scale has secured a foothold too well settled to be dislodged. You are relatively, if not absolutely, free from this danger. It seems to me certain that Michigan is going to produce less apples, very notably less apples in the future than she has in the past. It is going to be a hard struggle to grow apples in other states of the same latitude. Again, while I have seen immense orchards set out in Missouri and Arkansas, I can assure you that for the most part the varieties are such as not to compete with your products. The attempt is now made to get the apples into Chicago in May or June and the Southerners are planting trees with this in view. The market for such fruit as Maine can produce is going to grow better and better as our cities increase in population.

As to the matter of varieties, I have no suggestion to make farther than to urge you to secure the bulletins of your Experiment Station which are sent free to every one who writes to Director C. D. Woods, Orono, Maine, asking for them.

The soil might better be a clay than a light sand.

In selecting trees, if sufficient time is allowed, it certainly would pay to have young trees grown from root grafts made with cions selected by yourself from bearing limbs of fruitful trees having the fruit that just suits your demand. This is better than buying average nursery stock in the root grafting of which not enough care is spent in the selection of the cions.

When it is remembered that an apple orchard is a crop that takes many years to mature, it is evident that it will pay to have the soil in first-class condition, well fertilized and in good tilth. The young orchard is kept cultivated, using some such other crop to go with it as corn, not potatoes, because the cultivation should cease by the first or middle of August that the wood may be encouraged to ripen and be thus made more resistant to freezing.

A cover crop should be used each winter to prevent the loss of soil fertility. Some legume would be better if the climate will permit. Possibly crimson clover, sown in August, will withstand the winter and will store up much plant food, deriving its nitrogen from the air, as well as preventing the loss which would otherwise take place through the evaporation of water from the surface of the crusted, bare land. Remember it is not water alone which is moved to the surface as the exposed soil is dried out by sun and wind. The water coming up from the depth of the soil bears with it plant food in solution. This plant food is left on the very surface of the ground as the water evaporates. Imagine, then, what happens on one of your steep side hills when one of those sudden September thunder storms comes after a period of drought. This plant food so left upon the surface during the drought is washed away and the soil is impoverished. It seems to me that this is the chief value of a cover crop in an orchard, this prevention of the loss of plant food.

Your Experiment Station has performed a series of experiments on this very question of cover crops. I assume that you are acquainted with the matter.

As soon as the orchard begins to grow it must be trimmed. The pruning adopted in Michigan would not suit Maine conditions. Here the tree should be headed low and the limbs kept short. Winds are high, the seasons comparatively short and all conditions make for the relatively small and dense tree as against the more upstanding and spreading top. Of course the top must be left sufficiently open to admit the too infrequent sun.

Spraying must be attended to. Against the scab you must spray here as we do in Michigan with copper sulphate before the

buds start. In Michigan we spray with lime and sulphur to fight the San Jose scale. After the petals fall the second spraying is against the codling moth. Here arsenic is used. Other sprays follow until the orchard in Michigan may be gone over seven times. Spraying pays, neglect is expensive. Get your station bulletins for full directions in regard to spraying.

Finally, a recent examination of Boston markets has shown me how much depends on the packing of the fruit. One barrel of apples from which all seconds had been rigorously excluded was selling for $4.00, another for $5.00, and a third, of very choice fruit, for $7.00. Other samples containing some fruit as good as in the other barrels just mentioned but mixed with a small per cent of inferior stock, were selling for $2.50 to $3.50 per barrel. It pays, therefore, to select carefully, to pack nicely and to find your market.

In conclusion let a Michigan observer assure you that he believes that as the people of the country are awakened from their sleep and come again to their common sense, there will be a reverse current from the city countryward. These Maine farms are to go up in values per acre as they come more and more into demand. Apple orchards are going to cover your hillsides and the best fruit in the Boston markets is going to come from the north, not from the west.

THE PORK MAKING INDUSTRY IN MAINE.

By Dr. G. M. Twitchell, Auburn.

Pork making in Maine has never been looked upon as an industry to be pushed as other branches of farm work have been, and the common practice of growing one pig for family use and one or two for market, to pay the cost of the whole, has been accepted as sound and correct. A few who have established hog farms and been feeding from gathered swill, have continued year after year with varying success. Meanwhile the western farmer has been supplying us with hams, shoulders, breakfast bacon, fresh and salt pork, until the farmers have, in far too many cases, come to question if there can be any profit in the business. To be sure the Westerner has been shipping in young pork, not over six months old, quickly grown, and has doubtless smiled as he read of his eastern neighbor who has boasted, in the press, of his four to five hundred weight hogs, knowing that his corn has made that pork and that every pound over 250 has been grown at a loss. With these facts before me, and with a natural liking for a hog, I decided to make a practical test of the problem, find the cost of making pork, and at the same time the best and cheapest way to solve the question of profitable pork production for the eastern farmer. The experience of the entire West pointed to forage grown crops and pastured herds instead of pen feeding common in New England. Forest Henry and other well-known western growers declared this practice sound for Maine, and having faith in the hog, and the opportunity to test for myself, the work was commenced. Pure bred sows were purchased in December and wintered on rutabaga turnips, small potatoes, clover and a minimum of grain; only what was necessary to keep them in condition. From the first each pen was kept supplied with charcoal, ashes, salt and sulphur as follows: One bushel of charcoal, one bushel ashes, one-half bushel salt and four pounds of sulphur. These were thoroughly mixed and kept either in small boxes or in the corner of each pen. An abundance of water was also kept in every trough, as this was seen to be a necessity for the best health of the sows. In this way, with plenty of work on the

MAINE FARMER PRESS, AUGUSTA

Oats and rape between rows of apple trees. Sowed April 19. Hogs turned on, May 12, Elmwood Farm, Lewiston

strawy horse manure, and abundance of fresh air, the sows approached the farrowing period in the best of health. Here we began to feed a small ration of middlings, with reduced quantity of roots. Pens were provided, with guard rails eight inches from the dirt floors and a small bed of straw furnished, this being changed frequently to keep dry. When the pigs came some one was in constant attendance to prevent accidents, and then the sows were left by themselves for a day before being fed. The first ration was of skim-milk, with a little middlings and bran, fed warm, and very soon there was call for liberal rations. One fact noticed was that there was a decided difference in sows carrying the same number of pigs, in the quantity of food consumed, those requiring most being the heaviest milkers. Before the pigs were two weeks old, small, low down troughs had been provided and the food of the dams was being supplemented by that specially prepared for the young pigs.

When four weeks old, some of the best of each litter were weighed, the variation being from nineteen to twenty-five pounds. As these sows were carrying eight to ten pigs each, the difference in weight forced the conclusion that in future breeding the sows to be retained should be the most liberal milkers. Here was a lesson of signal importance, the full force of which was not realized until these pigs were three to four months old. The larger size obtained during the first four weeks gave a strength and vigor to the pigs which sent them ahead rapidly later on. As the breeding of the sows was practically the same, the sire the same, and the system of feeding the same, the conclusion was reached that the sows calling for most food and carrying the largest udder development were the best and most profitable.

Failing to have a field of winter rye to turn the pigs on early in May, as I surely would if the experiment was to be repeated, we broke strips of partly frozen earth between the trees in the orchard April 19th, sowing thereon at the rate of three pounds of rape and one bushel of oats per acre, using a small quantity of grain and grass fertilizer. May 12th, these five brood sows, with what pigs remained, were turned to pasture in this orchard and the grain ration cut down materially for the sows. Within two weeks a decided improvement in condition was to be seen.

May 12th ground was broken alongside the hog pasture, and one acre was sown to rape, clover and barley. This was old pasture land and very rocky. Here we used three pounds of rape, one bushel of barley and seven pounds of red clover, and on June 6th the opening was made for the hogs to run at will upon this acre. From this time until in September no food was given of any kind and the only labor item was to see that there was a steady supply of fresh water in the troughs, the orchard not having a natural supply. Above this acre and alongside the orchard one-half acre of corn was planted and one-fourth acre of pumpkins, and a portion of these last were thrown over the fence before the hogs were brought to the barn in October. In this way a good growth of the whole was insured, and the sows farrowed large litters in September, in the very best possible condition. The expense to the farm was that of labor, seed, fertilizer and time demanded to maintain the water supply and feed the pumpkins. The whole secret, if there be one, lies in growing a bountiful supply of rutabagas and mangolds to feed in winter, and in providing abundance of these forage crops for summer. Two years' experience has taught the falsity of many theories, and surely the certainty of mistakes. Hereafter I surely would provide a nearby field of winter rye upon which the sows could be turned early in May, if not in April, and on which they could feed while the rape, barley and clover were being sown and started. Then, too, the sowing of this combination should be at least in two periods, to insure succulence throughout the season. Beyond this, the pasture should include a stream, or abundance of springs, to insure an abundant water supply and save the time and labor necessary to furnish the quantity demanded for health and comfort.

Surely would I advise the use of the orchard, provided the trees have reached good size, because of the increased profit certain to follow. The shade of the trees will protect from the extreme heat of summer, while the work of the season will thoroughly fertilize every portion. From the first, the hogs and pigs will eagerly search for the small apples as they drop, and because of the thorough work done the orchard will be free from the ravages of the dreaded railroad worm, while size,

vigor and quality of the fruit will be materially improved and quantity greatly increased. In an orchard of sixty trees, twenty years old, a lot of brood sows and pigs will well-nigh pay for cost of forage crops grown, and for labor necessary, in the benefit they will surely render the trees and the fruit. There is no way in which an orchard can be fertilized so completely and thoroughly as is here indicated, and two or three years will practically free it from many of the insect pests.

Surely no man will for a moment think of leaving so valuable a lot of property alone, but will see every hog daily and, if they occupy an orchard, his eye should as often take in every tree. If extra attention is being paid to any one, a hoe and a few kernels of corn will easily center attention elsewhere until the whole ground has been fertilized and a goodly share opened to the sun and rain. With this precaution the orchard becomes an ideal spot for the hogs to pasture. The trees afford shade and the hogs will fertilize it in the best possible manner.

Had the experiment been continued another year, Canada peas would have been sown with the rape, clover and barley, at the rate of one peck to the acre. Adding this, a marked increase in feeding material would be secured. In turning on to any green feed, it will be found best to restrict to one hour the first day, though there is not the same danger as with other stock. The feeding value of rape is so great that it may well be attempted by each and every man keeping hogs or sheep, and the combination here given will be found to insure variety and extend the season with each. Growing these crops and keeping an accurate account of every item of expense, it was found that pork could easily be produced for less than three cents per pound. Those having a liberal supply of skim-milk can still further reduce this cost, and surely these figures must claim attention and provoke a test on the part of hundreds of the farmers of Maine. If this be the result, the full pocketbook will surely follow, for each year will witness an increase in brood sows and acres in forage crops. By this simple method the whole question of western corn in our pork-making problem may be eliminated, the home farm made to produce northern corn ample to finish off the forage grown porkers and put them on the market in best possible condition, and the farm

easily be made to yield all that is wanted to maintain the sows and grow the pigs. The call of the market is for the rapidly grown porker, and in its production there is greatest profit. Such pigs, to dress 200 pounds, should go on the market at six months old, and with two litters a year here is good business. It will not be possible to make pork as cheaply from October to April as during the summer months, but no man who has not tested the value of roots, vegetables, clover and home-grown grain can tell today what the difference would be. The first lesson to be received is that pork making is extremely profitable for New England farmers. When men come to believe this, the next step which has to do with the growing of the forage, root, grain and clover crops in largest quantity, will follow as a natural sequence.

In fencing an orchard, or pasture, whether with boards or hog fence, I would run a strand of barbed wire close to the ground as a safeguard against the pigs rooting under. The additional expense is slight compared with the safety insured. There is no fixed style of architecture, either in pens or houses. Every man must be a law unto himself. The one object is to protect from storm and cold and confine within proper bounds. He who commences on a simple scale will find it comparatively easy to add to or improve as he finds success awaiting his efforts. The essential is to start, and be sure to commence with good stock. The question of breeds is not here raised, as that must ever be a matter of individual fancy, but this much may be indicated, that he who thinks of realizing from his four-weeks-old pigs must take account of the whims of his neighbors, especially as regards color. Type is of far greater importance, and unless one intends growing the bacon hog with light quarters and long, slabby sides, the breed should be chosen with special reference to fullness of quarter and shoulder, roundness of body, intelligence of face, strength of leg and shortness of nose. In every case we want the drooping ear, not too large, as that tells of a quiet disposition. In these days no man can afford to use a grade male. If the first cross seems to be correct there is no certainty of its permanence. If grade sows are kept always patronize a carefully selected, well bred, pure bred male, and having made choice of any given breed cling to that year after year, thereby approaching fixedness in breeding. Well bred

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Result of feeding on rape, clover and barley at Elmwood Farm, Lewiston, 1906

stock will pay bigger dividends year in and year out than indifferently bred stock can. Above all, breed your own supply. Keep as many selected and tested sows as you can care for and out of two litters each per year make a business at once profitable and satisfactory. Looking for profit, the growing of the forage crops on which to pasture the hogs, also the corn and pumpkins, alongside the hog pasture, becomes of the greatest importance, as the labor item is thus minimized, a step the importance of which cannot at first be realized. Then, too, the liberty insured by this method induces larger herds, and the man who keeps four or five sows this year realizes how he can, by plowing a little more land alongside his hog pasture, carry six or eight and the pig revenue becomes a factor of importance in the year's account. Weekly there are received at one station in Maine from six to eight hundred pigs from the West, hardly one of which will dress over 225 pounds. These growers have solved the problem of profitable production and they send their forage-grown pigs by the thousands into our state, two crops a year, and surely must smile as they read of the two-year-old hogs slaughtered here by our farmers, grown almost entirely on western corn, the growers of which could not afford to feed it at home. From 175 to 200 pounds mark the limit of profitable pork production and this weight can readily be reached by the time the pigs are five to six months old. This insures two crops a year and may easily be made to add materially to the net income of the farm. For the past two years prices have ruled high, and the situation is such, throughout the West, that nothing except a financial panic is likely to make any decided change.

With this period of prosperity, with wages good and every man employed, consumption of pork products has increased much faster than production, and with the rapid increase of population nothing but enforced idleness can stay this demand. Thus from every standpoint the growing of more pigs for early marketing is to be urged upon the attention of the farmers of Maine.

In breeding with any view to selling small pigs, always reserve the largest, strongest, best-bodied ones for home growing. It

will always pay to sell the second grade, but never the pick of the flock or litter.

With the general increase in consumption of pork, there opens before the man who grows his stock on roots, vegetables, forage crops and home-grown grain, the opportunity for increased profits because of the absolute freedom from taint of city swill. Such meat becomes at once the sweetest, cleanest, healthiest of all meat products and the fact of its quality once established will insure a price above market quotations.

From every standpoint this method of growing pork presents positive attractions, and the limit is bounded only by the skill, energy and attention of the owner. There is no reason why Maine should not produce its own pork, hams, shoulders, salt pork and breakfast bacon, as well as by-products, and stop this enormous drain for the western-grown hog. By doing this millions would be added to the annual income of our farmers, and no man would be the loser. We have the pasture ground, can readily grow the forage crops, and, out of the improved manure piles resulting from the work of the hogs in winter, without detracting from the supply for other crops, grow the corn with which to fatten the yearly surplus. Commencing with the rape, clover, barley and peas, on which the pigs can feed at will, it may be found most profitable later on to allow them free range on the pumpkins and corn, thereby saving all labor of harvesting. Western growers declare that the loss by trampling is comparatively small, but whether this practice be applicable to Maine or not must be determined by experience. It is so contrary to our accepted ideas of economy that only the actual test can determine its cost or saving. One fact is certain—that but little or no loss was sustained in allowing the herd to have free run over the rape, clover and barley, while the amount of valuable food produced on an acre was surprising. As the barley which came first was eaten down the rape came, and as this was devoured the clover was coming, so that, when the pigs turned to this, the rape quickly threw out new leaves, thus keeping the field green and inviting through the season. The old idea that rutabagas are chiefly water and therefore of little value may well give place to a better conception of their worth as a steady article of diet for any animal;

for once let a fair appreciation of their value obtain and thousands of tons would be grown where now there is one. It is safe to count on a yield of from twelve to sixteen tons per acre and these can be grown close to two dollars per ton, so that, in the study of hog economics, this palatable, nutritious and inexpensive article of food must in the future play an important part in the making of the winter ration. If the hogs run on dressing from grain-fed stock, they will need but little corn or oats, if allowed a plentiful amount of turnips daily.

The question is often asked about cooking food for hogs. I do not believe that it pays, and neither in feeding turnips would I bother to cut them. Looking for the lowest cost all these items enter into the account and must be considered by each individual grower from his own standpoint. As numbers increase, the labor item will call for special attention, and while no neglect can be possible without loss, the system of feeding and variety of food will become of increasing importance.

Here is an industry which may be of immense value to the State of Maine if taken up thoroughly by our farmers and pushed energetically. Statistics gathered at the great shipping centers show that there has been a decrease of about 750,000 head packed the past season. More than this, the best authorities declare that it is impossible for the corn belt hog crop to ever again be displayed on a stockyard bargain counter. Each year adds several millions to the army of pork eaters, a fact that practically insures against possible over-production. Finding the low level of three cents in cost of production, the grower will not be disturbed by any fluctuations from present high prices. No matter what the point of vision, there is certain to be a wide margin for the man who selects and breeds with care, maintains the health of his animals and puts on the market choice pork made entirely from skim-milk, sound grain, rape, clover, barley and peas as summer forage crops and roots and vegetables for a winter ration. If the conditions allow no room for neglect, they surely promise abundant compensation for watchfulness, skill and businesslike attention to details. The hog crop of Maine may well be increased along the lines herein indicated, for there are good profits awaiting the man who apples western methods on his Maine farm.

REPORT OF PROCEEDINGS

OF THE

State Dairy Conference

AND

NINTH ANNUAL MEETING

OF THE

Maine Dairymen's Association,

DECEMBER 4, 5, 6, 1906.

The Annual State Dairy Conference, held at Music Hall, Farmington, December 4, 5 and 6, was a very successful one. There was the usual good attendance at the meeting, and much interest was manifested. The papers presented were fully up to the high standard of previous meetings, and the discussions were productive of much good. The exhibition of dairy products and dairy appliances was large and attractive, and the score received by the exhibitors of dairy products was higher than in any previous year.

A number of students from the agricultural courses at the University of Maine were present and added much to the interest and enthusiasm of the meeting.

TUESDAY EVENING, DECEMBER 4.

ADDRESS OF WELCOME.

By D. H. Knowlton, Farmington, Me.

"Farming," said Prof. L. H. Bailey in a recent article, "is becoming more difficult, and the old methods must go. In the future only the well-informed and efficient-thinking man can succeed: that is, only the educated man." I am glad indeed to welcome to our town these young men who come from the University of Maine and offer to us the results of their study of agriculture. I am glad also to welcome those who come from the study of the University or from the laboratory of the Experiment Station. They are the ones whom Nature, the old nurse, seems to take, saying:

> "Here is a story-book
> Thy Father has written for thee.
> Come, wander with me," she said,
> "Into regions yet untrod,
> And read what is still unread
> In the manuscripts of God."

I only wish that more of our young farmers could be here and listen to your words and profit by them. But I rejoice to know that so many of the better class of farmers are regarding an agricultural education as an essential part of successful farming.

The old State Board of Agriculture held its annual meeting in 1871 in this town. On that occasion the Hon. Hannibal Belcher gave the words of welcome: "We regard ourselves," said he, "fortunate that you should be able at any time to visit us." To-night as I stand before you I will reaffirm his words that we are fortunate to have this visit from you and I cordially welcome you one and all. That meeting of the old board here was a memorable one, for among those present were several who did noble work for the cause of Maine agriculture. The meetings were held in the old court house and I doubt if at any session there were a hundred persons present, and many of

those came in timidly as if treading on forbidden ground. "We have depended mostly," said the gentleman referred to, "upon our stock and very little grain has been sent from the county."

But as he said then, so say I now, "What we want in this matter is information; the experience of those who have been engaged largely in the business." That, Mr. President, is what we are assembled here for on this occasion, and I am delighted to welcome you to the pleasant duty before you, for no greater pleasure is given to man than that of teaching others by word and precept the way to better things. "People seldom improve when they have no other model but themselves to copy after," for "example is the school of mankind, and they will learn at no other."

Some of you are in Farmington for the first time, and it is always well to know under such circumstances something of the place and the character of the people. A little over a hundred years ago the first settlers came into the Sandy River valley. From the hills they chose the wooded land whereon they made their homes. The river wound its way through the valley then as now, and from the easterly bank their lots extended back for a mile, thus reaching up into the high land. It is about three miles below our village where the first settlers made their homes. They chose wisely and well, as you will see, for within my recollection a young man bought a $10,000 farm in this valley, and the mortgage was bigger than the farm, but before he parted with that farm the cows had wiped out the mortgage, and now another young man is doing the same thing. This is just what the well-managed dairy in Franklin county has done for many others. It has always been a paying business here.

Sweet corn is regarded as a desirable crop by many of our farmers, and the past year one of these nearby valley farms gave cash returns at the rate of $75 per acre. This particular farm is operated by a man of foreign birth, attracted to the locality by the real estate boomers, and he brought with him all the necessary machinery, and the corn crop to which reference is here made was probably grown with less hand labor than any piece in Franklin county. May we have more such farmers to help us solve the vexed "hired man" question.

The valley was rapidly settled, but there were many who chose the hillsides for their homes. The hills were hard to climb then just as they are now, but the joy of living among the hills is a peculiar one, which only those know who enjoy it. The hill farms of Franklin county are fertile and while the valley farmers seem to have less labor to operate their farms, the higher altitude has often saved a crop from the frosts.

One of these hillside farms last year produced 1,000 bushels of potatoes. This is not much, say you gentlemen from Aroostook, but those potatoes sold without storage for $650 or 65 cents per bushel. Another farmer in the northern part of the county has 1,000 bushels this year, and he is expecting to get a little more than 65 cents for them.

Thus from various centers the town and county became settled, and farming has been the chief occupation of our people. That they have found farming a source of reliable profit, the prosperous homes all over the county bear evidence. While you here especially represent the dairy interests, ours are more diversified. Last April there were 5,959 horses of various kinds in Franklin county; 8,536 dairy cows; 7,903 other cattle; 15,404 sheep; 14,543 swine. Dairying, as you see, is an important industry in the county. The Turner Center Dairying Association handles the most of the cream and for the year ending September 30th, the association paid its Franklin county patrons $168,987. The better to care for this large amount of cream, the association has erected a factory at West Farmington, at a cost of $6,000 or $7,000, where this cream is now sterilized and largely shipped direct to market. The cream taken by other factories and that made into dairy butter will bring the receipts for the dairy up to more than $200,000 for the year.

Thus you see, Mr. President, we have large interests in dairying, and our people will come in here to sit at the feet of those wiser than they are to learn the science and art of profitable dairying. You will find them good listeners and their welcome to you will be stronger than words of mine can express.

As to the town itself, Farmington stands out conspicuously among the towns of the State. Our manufacturing interests are not extensive, but our people are industrious. It is a matter

of local pride that our banks contain more money per capita than those of any other county in the State.

Public schools were early organized, but the people who came to this town to make homes wanted more for their children, and one of the first public buildings was the old academy where for many years the young men and women were taught in the higher branches of learning. It made the town in a peculiar sense a center of culture and influence that has had much to do with the social and moral atmosphere of the community. The time came when a sacrifice was called for, and where the academy stood arose the first normal school in the State. Year by year this institution has sent out large classes of young men and women to teach in the schools of the State. More even than the old academy it has made the village an educational center. Its management is efficient, and everyone has a special pride in the institution. I regret that the school is not in session this week, but the building is here and Principal Purington will enjoy having you all call.

For several years our public schools were overcrowded and there was a pressing demand for more room. It was finally determined by the school board to ask the town to erect a new high school building. When the matter came before the town the moderator anticipated a hard fight over the issue. A proposition to raise $30,000 for a new school building would require much deliberation in most towns, but without a word of opposition or a single vote against it the money was raised. The high school with nearly 150 pupils is now occupying the new building for the first term, and Farmington people would be delighted to have you visit the school.

The interest-bearing town debt is now $26,000, and our town tax rate for 1906 is just 13 mills. The village corporation, organized within the town, has a water debt of $71,000, and the water system, which is now just completed to Varnum pond, about five miles away, yields an annual rental of over $6,000. The rate of corporation tax is two and seven-tenths mills, so that the village resident pays a tax of .0157 on the dollar.

Franklin county owns its fine county buildings and has no debt. These low rates of taxation speak more plainly than words of our material prosperity. Not only do they speak well

for the present, but they also give promise of even greater prosperity in the years to come.

To-morrow in a nearby hall will be held the annual meeting of the Franklin County Agricultural Society, an organization created by act of the legislature in 1840. I think without interruption it has held its annual show and fair. It owns extensive grounds and buildings, expending in improvements the past year over $1,000. The first report I find was for 1857, when the receipts of the society were $388.01 and $340 was paid out in premiums. This year there were on exhibition at the fair nearly 600 head of cattle, 101 horses, 188 sheep, 5 swine, and 111 coops of poultry, besides a large display of vegetables, fruits, and domestic products. The receipts for the year were $4,005.06, and the awards made amount to $1,258.35 besides the races. As the representative of this society I am glad to convey to you these facts, for we hear so much said of the big agricultural shows in Maine.

Now, sir, I have by no means exhausted my subject, but I have endeavored to call your attention to some of our institutions and our natural resources. It is a pleasure to turn on the lights once in a while, because then we may see ourselves as others see us. You know now where you are, and somewhat of the people among whom your lot is cast the present week. In behalf of our citizens and the great interests you are here to promote, I welcome you to our home town. We are glad to have you with us and we will endeavor to make you so happy you will want to come again. Mr. President and gentlemen of the State Dairy Association, the town is yours.

RESPONSE,

By A. W. GILMAN, Commissioner of Agriculture.

Mr. President, Ladies and Gentlemen:

These warm words of welcome that have greeted us are profitable and bring us nearer together, and make better friends of us, and make us feel that we are one common family. The Maine Dairymen's Association accepts gratefully this kind hospitality that has been extended to it. This organization has done a whole lot of good things for this State and a lot of good things for ourselves. It is a characteristic of this society to make this—their annual meeting—one of great profit to the State, and that each annual meeting shall outvie the past. We have been animated by one single purpose, to make this organization strong, and to make it strong for the simple purpose of building up a great industry here in the State, and that is, a profitable dairy business. Our efforts are being crowned with success. All honor is due those men who conceived the idea and laid the foundation for this organization. They had minds and hearts to look into the future of this State and to conceive what might be done in the organization of a society that should instruct and spread knowledge among men who kept cows, tilled farms and raised crops. And from that time there has been a steady growth in the dairy industry of Maine.

It was by the earnest and united request of this organization that the State in 1903 appointed a State Dairy Instructor whose duty it should be to instruct, protect and develop this great industry.

We have been advancing all the time. We have been getting better cows, better farms, better buildings, and our homes are becoming more cultured, more refined, more convenient and more attractive. At the same time the process of education has been such that the farmers of this State have been taught to think, and to like to think, and to think to a definite purpose. The farmer has learned that in order to succeed in dairying he must exercise keen judgment and adopt business methods. In no other of our farm industries are the returns so prompt and so sure as those which the dairy offers. A business so indis-

pensable to the wants of the people and so profitable both to the farm and the farmer, is worthy of the best efforts of this association.

Mr. President, your program is rich, containing some of Maine's most practical, successful dairy workers as well as some of the best dairy experts of this country, men who have been identified with dairying and its work for a lifetime. They possess both the science and the art of this subject, and we are expecting much information from them. But the most satisfactory feature of this program is that you have made a special effort to induce some of the students of the University of Maine to take part in this convention. It is the young men that will soon have charge of this entire matter, and I hope we may so arouse, awaken and interest them that they will catch inspiration from this meeting and resolve now to train, prepare and educate themselves for this important business. This is the all-important work of this convention.

The remainder of the evening was devoted to the reading of essays by students of the University of Maine, in competition for prizes offered at the State Dairy Conference held at Pittsfield in December, 1905.

WEDNESDAY, DECEMBER 5.

THE HEAD OF THE DAIRY HERD.

By G. M. Gowell, Professor of Animal Industry, University of Maine.

One of the most difficult tasks man ever sets for himself to perform is the breeding together of two animals of apparently equal merit and determining beforehand what the offspring is to be like.

During all the years that have elapsed, since men domesticated cattle and commenced their improvement, the phase of the work that has received most thought, and been discussed more than all others, has been the relative influences of parents on their offspring. Theories have been set up, and vigorously advocated and defended, showing that the sire fashioned certain parts of the offspring after himself and that the dam controlled and shaped other parts of the unborn young, after herself. The

anterior parts of the new-born creature have been claimed as the contributions of parents of one sex and its posterior parts as the contributions of the other sex. The external form and markings of the young animal have been believed by some people to be usually like those of the sire, while its interior organs were expected to correspond to those of its dam. The function, disposition, and sex of the creature have been claimed as coming, regularly, from the male or female parent.

All of these theories and claims have been proved true when the data was secured by the observation of certain animals, and they have all been proven untrue, as laws in breeding, whenever the evidence has been collected from a field sufficiently broad to be reliable. So far as we have gone in the study of breeding, no man has yet solved nature's mysteries sufficiently to enable him to mould animals with that degree of accuracy that the potter moulds clay.

In discussing the subject which has been assigned me—The Head of the Dairy Herd—I have no right or disposition to claim for him greater influence upon the calves of his get than can be accredited to the cows with which he is mated, provided they are of equally good breeding and individuality.

Concede that the moulding influences of the male are equal with those of the female, and his importance becomes increased many fold, in herds, where he is mated with many females and contributes his half of form and function to all the new-born offspring of the herd. Surely, in this sense, it is evident that "the bull is half the herd." How important, then, that he be at least as well bred as every cow in the herd, so that he have as good, or better right, to claim his half, or more, in the makeup of every calf.

Every one who is at all familiar with the changes that have taken place in New England cattle during the last forty or fifty years knows that the changes are the results of mating bulls of the dairy breeds with cows of the old stock, and continuing the mating of pure-bred bulls with the grade heifers of the succeeding generations, down to the present time. These grade cows are the basis on which New England dairying rests today. As a whole, the stock is much better adapted to the special purpose for which we are using it, than it was when we began.

Much of the breeding has been good, for we have many grade herds that are averaging 250 to 300 pounds of fat per year. Much of the breeding and handling has been poor, for we have lots of cows that do not pay back, for the food they eat, better than did the old stock with which we started.

Much of this grade breeding has been sensible, for the males were selected because they were well bred and had individual merit, and poor cows were rejected in the matings. Much of it has not been sensible because breeders have been content to use bulls just because they were pure-blooded, without much reference to the producing abilities of their nearby female relatives.

Grade cows will continue to be the dairy stock with which we shall do business, because of their greater numbers and less cost. In this breeding, the rigid culling out of poor cows must be practiced and great care exercised in selecting the bulls to mate with them.

I doubt if since the English people set out to breed better beef cattle and running horses, there has ever been a time, or country, where the people have studied the mysteries of animal reproduction as have American breeders of American cattle and trotting horses, in recent years, and yet, we have learned no certain rules. We do not know how to breed cows that all yield heavily of rich milk, nor horses that all have great speed and endurance. Heifer calves are much more desirable than bulls, on dairy farms, and yet, we have no rule by which we can regulate sex at will.

But we have gained much since the start. We have better yielding cows and more of them, and faster moving horses and more of them, and we know some of the reasons why they are better. We have learned that the ability to yield, or perform, is as transmissible from parent to offspring as is shape, size, or color, if that ability is present in the animal by right of inheritance. Unfortunately, not all good performing animals have the ability to transmit their qualities, and so we have the uncertainties. But it is commonly accepted knowledge, that animals that are themselves good performers, and whose parents and grandparents are good in the same respect, have the right,

if not always the ability, to stamp their young with the same good qualities that came to them by right of inheritance.

A year ago at the meeting of this society, when discussing the source of the most valuable food supply for the cattle of New England, I said, "I stand for grass." I stand for grass today, and I also stand for pure air and exercise, for breeding animals; not such supplies of pure air as are fed in to them through tubes while they are shut into air-tight boxes during the whole winter. Such rooms, to be used in this way, are being advocated by lecturers on stable ventilation all over our Northern states. We have a similar system at the college, but we rely on it only when the temperature falls to from 10 to 30 degrees below zero—not once last winter and usually not more than five or six days or nights during any winter. The rest of the time the feed doors are open wide. The whole feeding room or driveway is open to all out-of-doors, through the large lattice-covered ventilators at the ridge of the barn. It does not freeze much in this cattle room, but sometimes crystals of ice show in the morning on the manure.

The animals kept under these conditions do not have as smooth coats and they may not give quite as much milk during extreme weather, as when they are in warm rooms, but I believe they are in far better condition to become the mothers and the fathers of the cows we are to do business with, than if they were given artificial summer temperatures in winter, with the withholding of an abundance of pure bracing air and moderate exercise.

I am aware that I am treading dangerous ground in saying what I have, for it is known that animals can warm the rooms in which they live by the heat radiated from their own bodies and lungs and the rigors of our northern winters be avoided.

I would use the system when necessary to keep the animals comfortable, but I would not draw the line of discomfort at above 32 degrees. Above that temperature in the room we never close the shutters and rely on the ventilating tubes to keep the air clean.

Almost invariably when I advocate the open air and cool rooms for dairy cattle someone feels hurt and informs me that he does not believe it necessary for cattle to go to the brook

and stand on their heads and drink through the ice—and we agree perfectly. I think it was John Gould who said that every time a cow filled up on fifty pounds of ice water she lowered her temperature so that she went half way to death—and he was pretty near right. We run a steam pipe into our trough and raise the temperature of the water to 60 degrees and the animals drink from fifty to seventy pounds at a time and never chill, or show any discomfort, which they sometimes do when the water is too cold.

The dairy cow is a good deal out of balance. When she was in normal condition she found food and shelter for herself and had no difficulty in living and perpetuating her kind. When man took her in hand he commenced to unbalance her. He took out in one place, and put in in another, until she has forgotten how to do anything, except make milk out of the food she eats. She cannot make flesh out of it and she hasn't native sense enough left to save her life were she turned out to shift for herself during a New England winter. Once she was of Nature's creation; now she is man's. Man has worked her clay over until he has made her the source of enormous quantities of the most luscious of human foods. He has spun his thread fine; so fine that she is like the touch of silk to the hand; so fine that she accepts man—her master—as her adopted son and yields to him that measure of her own life that Nature intended for the nourishment of her calf; so fine that her sons are unbalanced like her—bunches of nerves—more the work of art, than of Nature.

As races of men become wiser and weaker, so, as our animals have become wiser in the exercise of one function, they have become weaker in others.

City people recognize the lack of Nature in their methods of living and so teach physical culture to the younger children; the girls play basketball and tennis, the boys, baseball and football—and other people take golf as substitutes for the tasks which Nature imposed, when she required every creature to hunt for his own food and supply his own shelter. Each year, men and women leave their unnatural lives in cities and go out into the open world, where their fathers and mothers got their strength and vitality, hoping to store up enough of Nature,

in one short month, to enable them to do the work which they set for themselves, within the walls of shop and office, during the remaining eleven months of the year.

The bulls, in far too many of our herds, lead such lives of confinement and idleness as to render them unfit to contribute such constitution and vigor to their highly organized daughters as will enable them to milk deeply, reproduce themselves in their offspring, and last a reasonable lifetime. Dairy-bred bulls are bright animals and they do a good deal of thinking when given an opportunity to develop their senses. They are nervous and highly organized and when closely confined, fret for freedom, even though they did not have much of it in their calfhood days. They are erratic, of changeful moods, and at their best should never be trusted. I can mention half a dozen men in this State who were killed by their stock bulls. To shut them up by themselves, away from the rest of the herd, is the very worst thing to do. We cannot allow them football and golf, but we should try to substitute for them.

In our bull pen, which is 10x18 feet in size, we have an inch and a quarter steel rod 10 feet long, running along one side of the pen, three feet above the floor, and far enough away from the wall to allow a ring to slide from end to end of it, as the animal walks back and forth, he being attached to the sliding ring by two light chains which snap into the ring in his nose. He walks back and forth a great deal and gets considerable exercise. He is able to look across to the cows in the tieup, through his open door at all times. It is a very helpful arrangement and not expensive.

The best scheme I have seen in practice is that at the Billings Farm in Vermont, where a five-eighths inch wire cable 75 feet long is anchored at both ends and stretched about six feet above the ground. A sliding pulley permits the animal to walk or run 75 feet and return as many times as he cares to. The four mature bulls were given exercise in this way, in relays, every day. It is strongly constructed and no animal is likely to tear it down when attached to it by his ring. Clamps are bolted to the cable, far enough away from the ends to prevent the creatures from getting at the posts, at the ends. One of the bulls required two men with staffs to lead him out from his stall, but

he was well behaved when fastened out to the cable, in sight of the cows, just through the fence. It is the best arrangement I know of.

On the islands of Jersey and Guernsey, it seemed to be the general practice to tie the bulls out in the open fields, with a combination of chain and rope, a dozen feet long, running from the ring in the nose to an iron pin driven into the ground, in the same way the cows are fastened, except that with the cows the chain passes around the horns close to the head.

It is of the utmost importance that some method of keeping and handling bulls be pursued so as to save them until their value as sires may be known by the quality of their get.

It is not pleasant to have a bull break loose and take charge of the place, as I have had them do, but it is a chance that everyone takes when he retains a spirited animal at the head of his herd.

The selection of an animal to head the herd is a matter of the greatest importance. To the professional breeder who has made his herd, and knows the strong and weak parts of his animals, I have no advice to give. A man who has sufficient skill to breed a herd of females, to uniformity, knows better than anyone else their weaknesses, which he wishes to correct, and he also knows how to select a mate for them, who is strong where they are weak, but he has to take the chances of that mate's transmitting the desired improvement without interfering with the good qualities already prevailing in the herd.

To the farmer breeders who breed dairy cows for their dairy worth, I would recommend the plan of breeding to producers, to get producers. I would go to that breeder of pure-blooded stock, whose ability for truth telling is above question, and ask him to show me the individual records of his herd for as many years as he can. This he can do, for any man who is worthy the title of breeder knows the performance of his animals. Look among the bulls he has for sale, for one whose mother and both grandmothers have each yielded above 300 pounds of fat for several years in succession. Then look for vigor, and strength, and evidence of function in the individual and see that among his relatives there are no weaklings. Be sure that he has a good skin—soft and of fair thickness. I am afraid of a very thin skin. Beware of a hard one.

It is a misfortune to have to use untested bulls, but somebody must test them before their ability to transmit the qualities of the stock from which they were bred can be known.

"How long would I keep him?"—If his get were not good I would get rid of him as soon as I knew it.

If he got me a lot of heifers that developed into good cows, with clean udders, and capacity to do, I would keep him as long as I could without inbreeding far enough to interfere with the strength and size of his get.

"How far would I inbreed?"—I do not know.

At the college we have five heifers that are from one to two years old, whose father is their grandfather. They are the only ones we have. I think I have never seen a lot of stronger heifers.

"Do blood elements which are related, fuse and unite in the offspring, with greater ease, than unrelated blood?"—I think so, and yet, I would be far from advocating indiscriminate inbreeding.

I believe we should have great breeding establishments where the purpose should be to supply bulls for the breeding of business cows. I would have those establishments run on a plan that would keep the animals as much of the time in the open air, in winter, as they could be comfortable, and I would give free pasture runs to the cows, instead of keeping them tied up in the stables and wearing blankets all summer to fit them for the fall show rings.

That old relentless law of Nature which caused the inferior animals to succumb to the hardships of life and the weaker bulls to go down in the battle for mastership placed at the head of every group of breeding animals, a master who was the best of his kind.

In selecting the heads of our herds we should apply that same rigid rule of selection, and depend on his vigor as an indication of that prepotency, that shall enable him to transmit to his get the artificial milk producing capacity of his mother, in combination with the hardihood of his father, in such measures that he will contribute more than his half to his daughters. This I believe to be the bedrock principle on which the upbuilding of our dairy stock rests.

BOVINE TUBERCULOSIS.

By Dr. F. L. Russell, Orono.

Bovine tuberculosis is a fact and not a theory. It is no new statement that it is the most serious disease that the dairyman in the State of Maine has to contend with. The conditions that make it such are not new. Tuberculosis has been known and has prevailed for a long time, and if there is any consolation in the assurance that our neighbors are as badly off as we are, we have plenty of that kind of consolation. Tuberculosis is not confined to the dairy herds in the State of Maine; it is not confined to the dairy herds in any state or in any part of the globe. It is common among cattle the world over, with some slight and unimportant exceptions. No climate protects, no breed is exempt. No conditions under which we may keep the animals protect them from this disease provided they are exposed to it. There are conditions that favor the development of the disease. The owner of the cattle has very much to do with the health of the animals, but if animals are exposed they are liable to this disease.

THE NATURE OF THE DISEASE.

How do we recognize it when we see it? Unfortunately, it is not an easy matter. Many times we have it and do not know it. That has been a very common experience. During the life of the animal there may be no indications of disease, and the animal may still be a menace to the health of others and to human beings. It is a disease caused by the tubercle bacillus, and it is characterized by tubercles or nodules that may be present in any part of the body. We have other diseases in which there are tubercles, but this disease is caused by the tubercle bacillus, and these tubercles may be found in any part of the body. They present a somewhat characteristic appearance, but their appearance varies at different times. The newly formed tubercles are small, hardly to be discovered, dark colored, filled with blood and constantly undergoing changes. A little later these same tubercles are larger and have a center that is yellow,

and soft or hard as the case may be. These tubercles later may run together and form large tubercular masses that may contain solid matter. These may be found in the lungs, or in the lymphatic glands, or along the intestines, or in any part of the body.

THE CAUSE OF THE DISEASE.

The cause of tuberculosis was in doubt until 1881, when Prof. Koch discovered it as a vegetable parasite, the tubercle bacillus, and now we may say that tuberculosis in all animals, under all the varying conditions, is due to this one vegetable organism. There are other contributing causes, but the other causes may be present, and this cause being absent we have no tuberculosis. A tubercle bacillus so small that it requires to be magnified three or four hundred diameters in order for us to see it, is the cause of the trouble. How does this organism cause the trouble? How are animals infected? The stable in which healthy animals are living may be cold, it may be warm, it may be close, it may be open, it may be damp, the conditions may be as bad as you can imagine them, and the animals do not get tuberculosis. But provided the germs of the disease are present, provided you have one diseased animal in the herd, the other animals get the disease. Manifestly they must get it through some channel or entrance into the body. The organism on the surface of the body is not in a favorable condition to grow. It is simply a particle of dust. But the animal has to eat and to breathe, and in these natural functions the opening is made by which the animal may become infected. The animal eats the germs, they find their way into the body through the digestive tract. Animals may become infected, and do sometimes possibly, through the milk ducts and through wounds in the surface of the body. But practically, as we meet the disease, we find animals get it in two ways, they either eat it or breathe it in. Now as these germs enter the animals, in the food or air, they are simply minute particles of dust, and are still, in a sense, outside of the animal's body. They are simply in the passages that communicate with the external air; but when these germs find their way into these passages, and rest on the mucous membrane, they have the power of entering into the membrane. They may enter so deeply that they find conditions favorable for their growth, viz.:

food, warmth and moisture, and where they lodge they may grow, and the one organism that entered and contaminated the animal may in a few days be millions of organisms.

The food contaminated with the germs may be eaten, and some slightly abraded surface of the mucous membrane may serve as a favorable place for their growth. Now what takes place? At first they cause a little local irritation. It is just as though the part had been injured by a blow. There is a little inflammation there, a little increased blood supply, and the organisms as they grow throw out a poison that acts first locally, and we have an inflamed surface that is not easily discovered, less in area, perhaps, than the size of a pin-head. At that stage of the disease it would take a microscope to determine definitely that the animal had any disease. That condition may continue for a considerable length of time, for we find that these organisms do not grow without some opposition, in the living animals. It is sort of nip and tuck between the animal life and the plant life. The animal does not surrender at discretion. If he is in vigorous physical condition, the germs may just barely live and for a long time hardly get beyond that. So we have animals affected with tuberculosis for years, and but little diseased tissue showing. But the day comes when they catch the animal in a weakened condition. Conditions are more favorable for the growth of the organism. This little diseased area then enlarges more rapidly, and it chances that some of the organisms that are growing here find their way into a lymphatic vessel or into a blood vessel and are carried on to some neighboring part of the body, and where these organisms come they begin to grow, and we find them spreading from the first initial point to other parts of the body. During the early stages of the disease the progress is nearly always slow. We may kill animals that react to tuberculin and find only two or three little tubercles; we may kill others that have not been diseased any longer and may find great masses of tubercular growth. There is no uniformity in the way in which the disease spreads in the animal. The conditions under which the animal is kept have much to do with the progress of the disease. But the tendency is always towards progress and not towards recovery. The disease is an extremely

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fatal one for cattle, and one from which they seldom recover. The death sentence may be postponed, their lives may be prolonged, but the end is nearly always the same. Sometimes they may recover, but we cannot count on it. Where we are taking close account of the conditions of our animals, we sometimes step in and hasten the process, and bring the disease to a termination sooner, but if allowed to take its course, finally the animal dies, as a result of the spread of the disease until it affects the vital organs.

The disease, then, spreads from the first initial point. The tubercle, small at first, grows larger and other tubercles form. If the parts are not what we may call vital, if they are lymphatic glands, and the body seems to be supplied with a superabundance of these glands, there may be considerable disease and the animal not mind it. If the lungs become affected, or the liver or kidneys, then the end comes sooner, for these are more vital organs. But sooner or later these vital organs do become affected and the animal dies as a result of the disease. When the disease becomes general, the germs have spread through the blood vessels, and all the organs of the body are affected. We sometimes get this condition and we call it a generalized case of tuberculosis. The end comes soon. The usual course is, the animal becomes infected and under favorable conditions will live for a long time without much progress of the disease. Sometimes the animal has given birth to young, or been exposed to a bad storm,—something interferes with the vitality, and this gives the germ every chance, and it will grow more rapidly, the infection spreads to other parts and the end comes soon. Gradual progress, or sometimes almost none at all, during the first stages, and finally very rapid progress to the end.

HOW TO DETECT THE DISEASE.

How do we detect tuberculosis in cattle, considering the fact that most of them seem to be in good health? This is a vital point. There are three general ways: First, by physical examination. Now some cattle have tuberculosis and we know as soon as we look at them that they are sick. They do not seem well. Their hair points the wrong way, their skin is dry and hard, they are curled up, they are losing flesh, and not giving

much milk. They are not thrifty. These cases are not difficult to detect. We can pick them out quite easily. Then, again, another physical symptom of tuberculosis is failure to breed. Cows that have been bred regularly are difficult to get with calf. This may be due to tuberculosis. We always think of that as a cause for this condition. Cows that are affected near the surface of the body will show some condition that we can detect, like enlarged lymphatics just underneath the jaw, beside the neck. These glands are very frequently infected. We can feel those glands in every healthy animal. They are nodular in shape and somewhat soft, two glands of about uniform size. If these glands are diseased one of them, without doubt, will be considerably larger than the other, and it will be hard, or the cow will flinch somewhat when it is touched. The animal will frequently help us to arrive at the conclusion that the same is diseased.

Then, again, if the animal is infected in the udder and the disease has made some progress there, we find a hard swelling in one quarter of the udder. Of course our dairy animals, with very highly organized dairy organs, are somewhat liable to disease of the udder, inflammation of the udder, that has no relation to tuberculosis. We get a caked udder, etc. But provided the cow is apparently giving normal milk, and there is no evident cause for the hard lumps in the udder, and the lumps are not particularly sore but simply nodular in appearance, confined to one quarter, it suggests to us the possibility of tuberculosis. But it is very easy to get mistaken on these cases.

These physical symptoms enable us sometimes to determine what are the diseased animals in a herd. Again, a very important point to consider in determining whether a herd is diseased or not is by the appearance of the animals that are sold out of the herd to go to the butcher. The life of our dairy animals is limited. Every year many of them have to go to the butcher. Sometimes some of them die before they get to the butcher. In all these cases a man who is watching carefully the condition of his herd ought to know how the animals look on the inside, after they are dead. An examination of these animals that go to the butcher or die from other causes will often help one to come to a conclusion in regard to the animals that are living.

It is a very good plan for a man who is depending for his income upon dairy animals to know as much as he can about the inside of them anyway, and to improve every opportunity to see the anatomy of the cow after she is dead, and particularly, it is well for him in this connection to see the cattle that are killed from the herd. He may from that get some idea of what the condition of his herd is. Up to 15 years ago we would have to stop right here in what we had to say about the detection of tuberculosis in cattle. These were the only methods we had, and it was impossible to detect tuberculosis in a large number of cattle that were but slightly diseased, at that time. In 1890 Prof. Koch, who discovered the germ at first, had perfected a method of detecting tuberculosis in its incipient stages. He had manufactured tuberculin and had used it, so that it was recommended as a means of diagnosing tuberculosis in living animals. In 1890, 1891 and 1892, tuberculin was used by a great many men to determine the presence of tuberculosis. Now what is this tuberculin? In brief, it is beef tea and the products of the growth of the tubercle bacillus. It is made something like this: The tubercle bacillus does not grow very well in nature, except in living animals. It is what we call a parasitic, pathogenic organism. It will grow in living animals but it will not grow in nature anywhere else. Now by special care in the preparation of a culture, it was discovered that this organism could be made to grow in a laboratory. Beef tea was made, a little glycerine added to it, the living germs put in, and the beef tea containing the living germs put into a warm chamber and kept at about the temperature of the animal body; and slowly the germs would multiply, so that in the course of three months the beef tea would be filled with germs of tuberculosis. In growing the bacilli in beef tea, a certain poison was produced, the product of their growth, which is the essence of tuberculin. After three months the beef tea was sterilized by heat, filtered through a porcelain filter which filtered out all the solid matter, then the beef tea was evaporated somewhat, and we have the imported tuberculin.

It is beef tea that contains the products of the growth of the tubercle bacillus. It contains no living germs, no germs at all. It is a simple chemical substance that has been produced by the germs, and the beef tea in which they have grown.

Now this tuberculin, prepared in this way, was discovered to have the ability to help us detect tuberculosis, and in this way: A little of it, injected underneath the skin of an animal that is diseased causes, in the course of some hours, a rise of temperature in the animal. That rise is gradual. It remains at a maximum for a time and gradually declines. After the animal is inoculated the rise of temperature and decline follow in the course of 24 or 28 hours. The temperature has then returned to the normal. That is what we call a reaction. If the animal is sound the dose has no apparent effect. In this way we diagnose the presence of tuberculosis. This test is so simple and so exact and so reliable that it has come to be the one test for tuberculosis. We may make mistakes in diagnosing tuberculosis by physical signs. We may find a lump in the udder that we think is a tubercle, and it may not be a tubercle at all. Enlarged glands may not be the result of tuberculosis. Cattle sometimes are in a very unthrifty condition, and the cause is not tuberculosis at all. An expert can discover a good many cases by physical examination, but even an expert makes mistakes; and the great majority of cases he cannot detect at all, no matter how expert he is. Tuberculin is so exact in its ability to diagnose that the early developing cases are discovered with quite as great certainty as the later ones. And while it is not infallible, and certainly not infallible when it is applied by fallible human beings, it is certainly by long odds the most effective way we have. It has come to be regarded so in such an emphatic degree that there is no state in the Union but that is using it. The United States Government does not allow any cattle for breeding or milk producing purposes to come into the country without this test, and most of the states are as rigid in regard to cattle crossing the State line. Our most progressive breeders the world over are testing their animals in order to keep a knowledge of their condition.

MANNER IN WHICH THE DISEASE IS CONVEYED.

How does tuberculosis spread from one animal to another? How does the diseased animal convey the disease to well animals? We have noticed that the germs must find their way into the well animals by certain channels. How do they find their way out

from the diseased animals? In two or three ways generally. Here is an animal with the disease confined, we may say, to the lymphatic gland in the side of the neck; that animal may live in that condition for years and not infect any other animals. The disease is confined to that gland, and there is no channel of connection between that gland and the outside air. No germs are being cast off. This animal will stand side by side with other animals for years and the other animals not become affected. A little later the disease spreads and the lungs become affected. We have a little tubercle growing by the side of the air tube in the lung. This degenerates, breaks down, and pus is coughed out. Here we have the germs coming out in millions. Another way,—these germs set free in the udder of the cow are taken out in the milk by the calf and the calf gets the disease directly from the dam. Wherever a tubercle degenerates in connection with a passage of the animal that communicates with the outside air, whether it be in the lungs or in the digestive tract or in the udder, the germs are set free from the animals. We may have animals that for a long time are not infecting others in the herd. Suddenly a tubercle degenerates, and the germs are set free. Then it becomes a menace to every animal. We find some animals that are constantly a menace because we find sores in the lungs constantly giving off these germs. The animals are coughing them out, they are falling on to the food, they are drying and flying in the air and other animals are breathing them in. These are a menace to the other animals.

Now, there has been more or less said about the infectedness of milk from tuberculous cattle, and the statement has sometimes, even recently, been made that cattle never give off germs through the milk unless they are diseased in the udder. That is a theory that was considered well founded at one time, but that question has been studied very carefully and statistics are not lacking to show that any cow, we may say, that has tuberculosis in any stage, may at any time give off germs in the milk. Now that is a broad statement, but I have given it guardedly. Any cow affected with tuberculosis at any time may give off the disease germs in the milk. When we consider the probability, it is very evident that with open sores in the udder the germs must

be present all the time. An animal with disease in the lungs may not ordinarily give off germs, but just as sure as the disease may be spread through the blood vessels and the lymphatics, just so sure the germs may find their way out of the animal through the milk at any time. We are not justified in regarding the milk from tuberculous cows in any stage as being entirely safe food for other animals.

METHODS OF PREVENTING THE SPREAD OF THE DISEASE.

The disease is not curable, according to our present light. There has been a great deal of study put right on this subject of finding a way to cure tuberculosis in cattle, but up to the present time no reliable method has been discovered, though sometimes animals do recover. Failing of a cure, what shall we do? There has been just as earnest search, perhaps, in recent years when there has been some little encouragement, to find a preventive for this disease as to find a remedy. This is an age of vaccines and lymphs for rendering animals immune, and for at least sixteen years different investigators have been trying to discover means for the prevention of this disease. Different methods have been used. Tuberculin was tried for this purpose. Sound animals were inoculated repeatedly with the hope that it might protect them against infection, and there was some little evidence that they were protected, in a degree. Animals constantly injected with tuberculin are not likely to take the disease, but the protection seems to be only temporary and not very sure. Next they tried the injecting of the dead bacilli. These cultures grown in the laboratory were killed by heat and the beef tea and the dead germs were injected and some measure of protection was gained in that way. But up to the present time it has not been found a very satisfactory way of protecting animals. Another method that bears some relation to the Pasteur method of vaccination for the cure or prevention of rabies is by the use of the living germs. Now at first that seems a little peculiar, that we would deliberately inoculate cattle with this germ of tuberculosis while it is still alive with the view of getting any good results. But it had been discovered that while the living germs right from an animal that is suffering from tuberculosis, a cow, for instance, injected into another

animal will grow there and produce the disease, if these same germs are grown in the laboratory through generation after generation they lose in some degree their ability to grow in living animals. They do not grow as readily in living animals as before they were grown in the laboratory. It is found that the germs that have originated in human beings are not quite as virulent in cattle as those grown in cattle. We find that these germs grow in a great variety of animals, but as they grow in different animals they acquire certain characteristics that are peculiar to them in these animals, and so we get an attenuated virus, as we say, either from human beings or by growing the bacilli of bovine origin in the laboratory, through generations. In these ways we get organisms that do not grow very readily in cattle. Now briefly, we will say that this is the most promising line of investigation for getting a virus for vaccinating to prevent tuberculosis at the present time. A great many are working along this line. They are endeavoring to perfect this virus so that it shall have just the right strength; it must not be too weak to protect the animal, it must be weak enough so that it will not grow in the animal to any great extent. But it must protect the animal so that the stronger virus of the natural infection will have no effect upon it. There has been a good deal of success along this line of preventive inoculation. Veterinarians the world over are expecting, with a good degree of reason, that in the not distant future a method of protective inoculation will be available, at such a price and with such safety to the animals and human beings as will warrant its quite general use. When we have said this, we have said practically all that may be said in regard to the matter at the present time.

Dr. Salmon, who was for over 20 years at the head of the Bureau of Animal Industry, last month published a bulletin for the Bureau on the subject of Bovine Tuberculosis, and in this bulletin he has collected together the reports of the work that has been done along this line the world over for the last 15 years or more. In this bulletin he says: "The ablest veterinarians in the world are confidently expecting that a practical and safe plan of procedure will soon be developed." And then in conclusion he says: "There is still much to learn about 'vaccines' and their effect, and the owner of cattle will be wise to avoid their use

pending further investigations." He qualifies that somewhat in another sentence by saying that under peculiar circumstances there may be cases where it would be wise for men to have their animals vaccinated, but his general advice is that it is a little premature at the present time. We are not quite sure enough of our ground to advocate the general use of vaccines as a preventive of tuberculosis.

I want to say in regard to getting rid of tuberculosis that we first have to know that we have it, and a word in regard to the tuberculin test might not be out of place here. The tuberculin test is performed by a great many different individuals under different conditions, and the method of performing it is not entirely uniform, but after all there is a right way to do it and there are probably quite a good many wrong ways. It is well for us to have in mind something near what the right way is. An approved method of performing the test is something like this: In the evening, from 8 to 10 o'clock, the temperature of the animals to be tested is taken. If their temperatures are normal or practically so, the tuberculin is injected at that time. For a mature animal weighing about 1000 pounds, we would inject, of the tuberculin made in this country ready for use, two cubic centimeters; of the Koch tuberculin, the same amount of the ten per cent solution. For a calf ten days old, about five drops. The dose would vary somewhat with different animals, according to their size. Eight or nine hours after the injection is made, the temperatures of these animals should be taken again, and they should be taken at intervals not exceeding three hours until four temperatures have been taken. Now Dr. Law, Dean of the Veterinary School at Cornell, says the temperature should be taken at intervals of two hours during the day succeeding the injection. Dr. Salmon, Chief of the Bureau of Animal Industry, said that the temperature should be taken from early morning until late at night at intervals of two hours, the day after the injection. Certainly the taking of four temperatures at intervals of three hours is not any too careful work. The objection to the frequent taking of the temperatures, in practice, is that it costs money. It costs something to have animals tested anyway, and the cost is sometimes a stumbling block in the way of having the test made at all, and the least trouble

that is required in making the test, if it can be a satisfactory one, the better, and the number of temperatures that will reveal the condition of the animal is really all that we need.

If, when the fourth temperature is taken, there has been no reaction, the animal may be considered as having passed the test. If the temperature at the fourth test is rising, and we are in some doubt at that time, continue to take the temperature as long as it rises, at intervals of three hours.

Now the animals that have passed the test are probably sound as far as this disease goes. But this test is not infallible. Here is an animal about ready to drop into the grave. Poisons do not have much effect upon her. We do not need a test anyway, in that case. We can discover the disease without. On the other hand, here is an animal that has had tuberculosis for a year or two; the disease is confined to a little tissue not longer than the end of my thumb, and has not made any progress during that time. The germs are there, there is a little tuberculous tissue, there are germs that may begin to grow, and are likely to, but for the time being there is no progress. That animal, tested at that time, will not react to the test; so that a small percentage of the animals suffering from the early stages will not react. But if the test has been properly made, and right conclusions are drawn from the temperatures, and a consideration of the animals, the animal that reacts is tuberculous. There are some conditions which must be observed. A little tuberculin is injected into an animal last night, and that animal may become feverish today from some incidental cause. If she is driven about in strange quarters, or food is withheld, or the animal is in heat, she may have a rise of temperature that has no relation to the test at all. There is a chance for the exercise of good judgment and skill, and for experience to count, in making the test. We cannot just read the temperatures and say, this animal is diseased. But if the rise of temperature is due to the injection of tuberculin, we are safe in saying that the animal is diseased. We may sometimes make mistakes in deciding what is the cause of the rise of temperature.

Ques. Do you think it safe to go on one initial temperature?

Ans. Yes, if that is a normal one. It may be along the line of safety to take more, but it is not along the line of the practical working of this test. I may take the temperature of one thousand animals at 8 o'clock at night and may inject the mature animals that have a temperature below 102½ degrees, and I will not make a mistake in testing them, one time in a thousand. If the temperature has gone up gradually, the day after the injection, and remained stationary for a time and gradually declined, it is a normal reaction; and the chance that an animal suffering from fever of an incidental nature will exhibit that normal tuberculin reaction just the day after the tuberculin is injected, can almost be disregarded. If we were to take the temperature of these cattle at intervals of three or four hours, for 24 hours before the injection, we should pretty nearly double the cost of the test, and in that way render it somewhat impracticable. In giving the method I do, I do not claim that it is the most approved way that the test could possibly be made, but I believe it is the most practical way, and the errors will be very rare. We must have the work done as cheaply as we can without sacrificing safety in order that the test may be a practical one.

Ques. Do you say that after the 4th time of taking the temperature, if it is found continually rising, it means that the bacilli are present?

Ans. Sometimes we have a delayed reaction, but usually we get the highest temperature certainly within 18 hours; sometimes it comes as late as 22 hours. If at 18 hours after injecting the tuberculin we find the temperature somewhat elevated, going up a little, and we are not quite satisfied, it is not high enough to consider it a reaction, we will continue to take the temperature of that animal once or twice more. We occasionally get a reaction with the maximum temperature, that we would not have considered a reaction at the fourth taking of the temperature.

Ques. The reaction indicates the presence of the bacillus?

Ans. Yes, of growing germs.

Ques. Is it not a fact that the majority of animals reach the maximum temperature at 14 or 16 hours?

Ans. They usually reach the maximum at about the 15th or 16th hour. The younger the animal, as a rule, the earlier the rise to maximum temperature.

Another point in making this test: The first test that is made we regard as the most satisfactory. We may test an animal today and she reacts. We may test her tomorrow and possibly she will not react. If for any reason we test an animal today and we are not satisfied with the results, in order to get another satisfactory test we must delay the retesting as long as may be. We do not ordinarily retest under a month. And in making the second test it is generally advocated that a double dose of the tuberculin be used, at least with old animals.

HOW TO STAMP OUT THE DISEASE.

In regard to what shall be done with a tuberculous herd, how it shall be handled, how we shall get rid of tuberculosis if we have it, with the least trouble and expense,—there are two ways advocated and both of them are followed somewhat. One way is what is known as the Bang method of handling tuberculosis. In Denmark 50 per cent of the cows are tuberculous. Manifestly it would seriously handicap them in their dairy industry if they were to test and kill 50 per cent of their cattle. It was not considered a practical thing to do. Bang developed this way of handling the matter: Cattle catch tuberculosis from each other. So he tested the herds and divided them, putting the sound animals into a clean barn which was not contaminated, if possible, and keeping the diseased animals in the old barn, those of them that were in physical condition to do good work in the dairy. He sterilized the milk of the diseased cows and fed it to the calves of the diseased herd that had been transferred to the well herd. The basis of this method is this: The calves from the diseased cows are nearly always sound when they are born; they get the disease later. These sound calves from the diseased cows are put into the sound herd, and in that way we keep the blood of the diseased animals, which may be very desirable to retain. The diseased animals gradually pass off the scene. As soon as they are not profitable to keep they are killed. In Denmark if they are not thoroughly diseased they sell the meat and the people eat it, but we cannot do that here. In that way the man builds up a new herd of sound cattle quicker than he could by exterminating the diseased animals at once, and perhaps with less expense. Following that method, every six months the

man has to retest, and once in a while an animal from the sound herd has to be transferred over to the diseased one. Finally, if good care has been exercised to make a sharp line of division between the sound and the diseased herds, if they are in separate barns with separate attendants, in course of time he may have a sound herd.

The objections are very evident. The man has to maintain two herds, in two barns, with two corps of attendants to make this method thoroughly satisfactory; he has to sterilize the milk, and these animals are not as productive as healthy animals. It costs money to keep animals anyway, and the best and soundest are none too good. In this country this method has not been found very practicable. In the State of Pennsylvania, where the State laws allow the use of this method, and the option is always given the owner of the herd whether he shall have his herd cleaned up at once or retain the diseased animals, the report of the authorities is that the Bang method is seldom used. One herd in the State of Maine is being treated in this way at the present time, but the conditions are exceptional where a man has another uninfected barn somewhat removed from the general herd barn and a man who can take care of these animals and not go near the sound animals, and where he can sterilize his milk and use it profitably. It is not a common method but it certainly ought to be allowable, and under some conditions it may be wise to follow it.

The other method is known as the slaughtering method. That is rather a harsh way of putting it, but that is about what it is. We simply kill and make phosphate of or bury the diseased animals, disinfect the barns and have a sound herd from the start. But the slaughtering is only a part of it. We have slaughtered the animals, but we want to continue in the dairy business. What are we going to do? We do not want to burn down our barns and build new ones; we want more cows and have to keep them in the same old barns. It is just as important that we disinfect our barns as that we get the diseased cattle out. In getting the cattle out we do not accomplish anything, in a sense, in the protection of other animals. The tubercle bacilli remain in the barns. If we have got rid of the cattle we have left the germs and if we put new cattle

in right where we have taken out the diseased cattle we are subjecting the new cattle to the disease. The mistake has been made, of putting cattle into the old barn without killing the germs. It is just as important to disinfect the barns that have been infected with the tubercle bacillus as it is to get out the diseased cattle. It is not an impossible thing to do. It is not always an easy thing to thoroughly disinfect an old, rough, open barn. It requires a great deal of painstaking effort, and there may be conditions under which the cheapest way to disinfect is to burn, but that probably is not often true. We have found, in practice, this method to be very satisfactory, for disinfection: The barn is first emptied of stock, fodder and utensils, as far as the disinfection would hurt them, then it is cleaned by sweeping it and washing up the manure in the tie-up, cleaning it about as water will clean it; then it is thoroughly sprayed from the ridgepole to the basement of the cellar with corrosive sublimate solution, one part of the sublimate to 1000 parts of water. Corrosive sublimate is as effective a disinfectant as we have. Whatever germs are touched by the solution are destroyed. The only point to be observed is to touch them all, and this is not always easy. But with a force pump on a barrel and two careful workers, one to work the pump and the other the spray nozzle, the barn can be literally washed all through with this corrosive sublimate solution. And we believe that, considering cheapness and effectiveness, this is the best method to be adopted. Possibly there is another method that may supersede this because of the ease of applying it. It has only recently become available. For disinfecting houses formaldehyde gas has been used for a number of years, and in limited areas, that can be closely sealed up, this formaldehyde gas has been a cheap and effective means of disinfecting. It has not been available for barns because we had not any good method of generating the gas fast enough. We cannot close up a large barn quite as tight as a sealed room, and there are more ways that the gas will get out. And if we cannot get a good deal of it in a room at one time it is not effective. There has recently been discovered a method of generating it more rapidly, so that choosing a calm day, closing our barns as carefully as they can be closed, stuffing rags into the cracks, closing the windows and battening the doors, the gas may be gen-

erated so rapidly that probably it is going to be a very effective method of disinfecting. It consists in putting the water containing the formaldehyde into a jar that contains permanganate of potash and then getting out of the room just as quickly as possible.

Ques. Do you think it will be as effective as the corrosive sublimate?

Ans. In careful hands I think it will, and the work has to be carefully done with the corrosive sublimate. I shouldn't wonder if sometimes it would be wise to do both things. You do not get the corrosive sublimate into all the cracks and crevices quite as you can get this gas, and both might be done to advantage.

Now when we get clean from the disease, how are we going to keep clean? I would like to tell a story, one that has been repeated in practice a great many times in the State of Maine. One of the most progressive men in a neighborhood was not satisfied with the cattle his father had left him on the farm. He wanted better stock. He fitted up his barns somewhat and went out and bought some registered stock of the breed that he preferred. He bought with a great deal of judgment, he did not rely entirely upon his own judgment, and he did not spare expense particularly. He got the best animals of that breed he could get and brought them home. He took good care of them and bred them wisely, weeding out his herd and keeping only the best. He took his cattle to the fairs and exhibited them, and his judgment in buying and breeding was commended by the judges. He carried home the blue ribbons. He got his herd up to the capacity of his farm, and then he had some surplus stock. He had advertised at the fairs and now he was advertising through the papers and buyers commenced to come. He was just in a position to reap the fruit of his effort of years, practically his life up to that time. He sold an animal and the man who bought it soon came back to him and told him that the animal was not right, she was diseased. He investigates the condition of the herd and the State buys the most of them and turns them over into fertilizer. He has been breeding tuberculosis all the time. That is not a new story. They are not doing that as much as they did, but it is a story that has a great many

chapters to it. It has been repeated time and time again in the State of Maine. There was an excuse for it at one time, it was practically the only thing a man could do, unfortunately. He bought cattle with the best judgment available, and he bought diseased cattle and bred the disease. He could not do any other way. But that time has passed. The man who goes out now and does that thing has only himself to blame for it. He can have his cattle tested when he buys them. He can be as sure of the health of the animal as of the other qualities, and if he does not buy tuberculosis he will not have it. When a man has tuberculosis in his herd he has bought it sometime, somewhere. He did not breed it there at first, he just bought it. He does not always know just where he bought it, but he certainly bought it somewhere. But we do not need to do it now, and the man who continues to buy tuberculosis and sell his cattle to the State is almost criminally negligent. The history of the herds of registered cattle in this State is not one to be proud of. The commissioners tell us that 20 per cent of the registered cattle that have been tested in this State have reacted to the tuberculin test. That is a high percentage. I do not suppose there are over one or two per cent of all the cattle that are tuberculous. Why are there 20 per cent of these and not a higher percentage in the State? It is just this way: The man who has built up a registered herd of cattle has had more chances to buy it than a man breeding native stock. In the past he could not avoid buying it.

Ques. Is there any danger of carrying the disease in clothing?

Ans. Yes, sir, probably some little danger, but when I say a man buys the disease that practically covers the whole of it. There may be a case where a man who has tuberculosis and is coughing and spitting around carelessly will give it to the animals but that seldom happens. It is just possible, too, that a man may carry dust enough from one contaminated stable to another, but we may almost disregard that.

Ques. If you have an animal in your stable that has tuberculosis, and the rest of them are breathing those germs are they bound to get the disease anyway?

Ans. No, sir. But we will say this. Bovine tuberculosis is very contagious and cattle that never see the inside of a barn catch it from other cattle. They have a higher percentage of tuberculosis in the Argentine Republic and out in Australia and New Zealand than we have in this country, and the cattle are not housed, and they have an ideal climate. It is a contagious disease for cattle without doubt. They are liable to get it when exposed, but not sure to.

Ques. Keeping the cattle in the open air, then, is not a preventive, if you have the disease in the herd?

Ans. The closer you keep the cattle confined with the diseased cattle, the more liable they are to be diseased; but there is danger just as long as sound cattle associate with diseased ones, no matter whether out-of-doors or in a house. The danger is greater the closer the association.

Ques. How young a calf is liable to get this disease?

Ans. It may get it the day before or the day after it is born.

Ques What is the difference, if any, between bovine tuberculosis and human tuberculosis?

Ans. It is a difference in the species. It is the same disease but affecting different animals.

Ques. Five years ago I bought a bull calf from out of the State. At that time they gave us a permit to bring him in and it was not necessary to have him tested. Wasn't there danger of his having the disease?

Ans. Yes, sir. How much danger the members of the cattle commission will tell you today. That permission would not be given you now. You will have to have him tested after getting him home in the future.

Ques. Speaking of a physical examination to determine tuberculosis, you did not refer to an enlarged joint. Is that an indication?

Ans. Yes, an animal that goes lame without any evident cause of injury should be suspected. A soft swelling on the knee is more apt to be produced by friction against the stanchion, but lameness in any joint may be caused by tuberculosis.

Ques. Suppose a man has a cow suspected to have tuberculosis. Would it be possible to inject tuberculin before the test so that she will not react?

Ans. Yes, sir, so that she *may* not react. The first test is more reliable.

Ques. Are there any leading indications of tuberculosis?

Ans. If you have but one animal it is pretty hard to detect it unless she is in an advanced stage. If you have a large herd and you know you have the disease in the herd, you can sometimes make up your mind that other animals have it, with very slight indications.

Ques. You cannot go into a herd and stand there a few minutes and observe them and determine whether or not they have tuberculosis?

Ans. No, unfortunately not, or you would not have to apply the tuberculin test.

Ques. What are the leading symptoms?

Ans. Unthriftiness, coughing, enlarged glands and lameness are indications of the disease; but the majority of animals that have tuberculosis do not show any of these symptoms.

Ques. You would not suspect a cow with a good, thrifty coat and appearance, lively in every way, would you?

Ans. Unfortunately every animal is suspected until it is proved sound. We suspect every animal of having tuberculosis until she has a clean bill of health. The only safety is to have them tested.

Ques. How much of a rise in temperature do you consider a reaction?

Ans. That depends somewhat on the initial temperature. We do not ordinarily reject an animal unless the maximum temperature is over 104. A calf six months old may sometimes have a temperature of 104, and not be rejected.

Ques. If the initial temperature was 102 and there was a rise of two degrees, would you call it a reaction?

Ans. If 102 was a normal temperature, and we could not account for the rise in any other way, we should be obliged to say that the cow had tuberculosis.

Ques. What is the danger of infection from the use of milk?

Ans. The milk may convey the disease to other animals. There is no safety in using it uncooked.

Ques. What is the danger to human beings from drinking the milk?

Ans. They are liable to get tuberculosis.

Ques. We understood you to say a moment ago that bovine tuberculosis affected only cattle, while the human germs affected human beings. What danger is there in humans drinking milk from tuberculous cows?

Ans. They are liable to get bovine tuberculosis. It is the same disease in different animals, that is all. It has been proven beyond doubt that the milk of tuberculous cows may contain the germs and may convey the disease to any other animals that take the milk.

Ques. How long, in your opinion, would these germs live in a barn?

Ans. They may live for months in dark sheltered places.

Ques. If all diseased animals had been either destroyed or quarantined and the barn cleansed as much as possible, after ten months or a year's time would there be any live germs left?

Ans. If you kill all the germs by disinfection, you can put cattle in at once. If that is not possible the barn should be kept vacant a year at least.

Geo. A. Smith—We were so unfortunate as to have tuberculosis in our herd. Dr. Russell said he did not believe the Bang method was practicable for farmers. I would not say it is, but still we carried it through. We had, at the time we tested them, about 30 head of cattle. A little over half of them were diseased. We had quite a good many valuable, full blood animals among them, that we did not feel like sacrificing. We disinfected the barn thoroughly, and then we washed it thoroughly, and kept our sound animals in that barn. We had another outbuilding that was fairly comfortable, and we put the diseased animals into that building, and as soon as a calf was born it was taken away from the diseased mother and put into the sound herd. The milk of the diseased animals was run through a continuous pasteurizer at a temperature of 85 degrees, and butter was made from that milk, and the skim-milk was fed to the calves. We used the milk right along and it had no bad effects. This was in 1900. Last year, 1905, in the fall, we had grown up a sound herd of as many animals as we started with, and we had been able to preserve that good blood. We had two men, one man who worked in the barn with the sound animals, and another

man who took care of the other herd and who changed his outer clothing and his shoes and washed his hands when he went into the barn with the sound herd. We have tested the herd every six months, it was tested a few days ago, and we have had no trouble with the sound herd. We have had to remove only one animal from it. In the diseased herd some of the animals broke down, but several of them that were younger animals at the time of the beginning of the test went through to the end of the test, and were killed and examined at that time. While they were all infected, some of them were infected only to a very slight degree and in two or three cases the infection was practically encysted. When we had replaced our herd we killed all of the animals in the diseased herd, to discover their condition. We did not care to keep them any longer, as we did not want the trouble of keeping an extra herd and an extra attendant.

Dr. Newcomb—Dr. Russell has treated very thoroughly the subject of tuberculosis and has mentioned protective inoculation. I would like to describe to you briefly the method of Prof. Von Behring and some of his success. Prof. Von Behring, after having discovered the anti-tocsin for diphtheria, turned his attention to the relations between human and bovine tuberculosis. He discovered that by inoculating cattle with the germ of human tuberculosis they were rendered immune to the bovine germ under certain conditions, and it took him some time to find out what those conditions were. Dr. Russell told you of the attenuated virus. It took some time to prove all this. The principle is the same as that employed in vaccinating against smallpox, in which instance the bovine virus is introduced into the human subject. The material employed in this vaccination is derived from the culture of the human tubercle bacillus so treated as to destroy its virulence. It is not a lump of serum or a mass of dead germs, but living germs which give, during the process of their absorption into the system, an immunity. Animals best suited for this vaccination are calves from two weeks to three months of age, although animals up to one year of age may be vaccinated, provided they have been previously tuberculin tested and do not respond to the test. Even if there is incipient tuberculosis there is a tendency to cure or arrest such disease, and the acquirement of immunity against natural infection. This cura-

tive property is only demonstrated in the younger animals. It is for this reason that it is not necessary to test animals under three months of age. The producing of the immunity consists of two inoculations, with an interval of three months between them, the second inoculation being five times the strength of the first. The animal is prepared for vaccination by clipping the hair from the jugular vein near the base of the neck and disinfecting the area. The vaccine is prepared and is drawn up into the barrel of the hypodermic syringe. The operator inserts the needle into the vein, and waits until there is a satisfactory flow of blood to be sure that he has properly reached the vein. Then he introduces the vaccine, with the syringe, slowly into the circulation, throwing it against the current of the blood so that it will be divided and evenly distributed and not go in in one bulk. The germs thus introduced into the circulation are slowly but surely absorbed or destroyed, the process taking several months. Hence the interval between the two inoculations. So long as unabsorbed germs are present, which after the second inoculation may be for several months, there will be a sensitiveness to tuberculin injection in these animals. The immunity produced, even a few months after the second inoculation, is so strong that it requires ten times the amount of virulent tuberculous matter which is fatal to the unvaccinated animal to have the slightest effect on the vaccinated one. Numerous experiments have been conducted at experiment stations in Connecticut, New Jersey, Maryland, Minnesota, California and Virginia, and at the present time the State Veterinarian of Minnesota will admit vaccinated animals into the State without a tuberculin certificate, and he is introducing a bill into the State legislature to appropriate $5000 for the purchase of bovo vaccine, to stamp tuberculosis out of their herds. Over 70,000 head of animals have been vaccinated, and there have been no unfortunate results. In these experiments at the stations animals have been used to check the results. For instance, six or seven calves are vaccinated and six or seven more tested and found not to be infected with the disease, and both lots are subjected to the same conditions. They have been fed tuberculous matter, they have had it injected into the jugular vein and had it introduced under the skin. After a certain length of time both sets of animals have

been destroyed and post mortems held, and they have never failed to find the disease in the unvaccinated animals and have found no lesions in the vaccinated animals except in a few instances where it was known that they were slightly affected before the vaccination, and in those instances the disease is found to have been checked.

Ques. How long has that immunity been found to continue? How many years after vaccination?

Ans. The process is young, it is only six years old, but the immunity does not decrease. Animals that have been immunized have been subjected to artificial injection, and have not taken the disease. The inference is that it is good for the life of the animal, or for a period which would practically include the useful life of the dairy animal.

Mr. Gilman—I would like to ask Mr. Deering, when animals have been slaughtered what steps the cattle commissioners have taken to disinfect stables?

Mr. Deering—I am glad that that question has been asked and I will briefly state what the commissioners are doing along that line. Years ago we did not pay much attention to disinfecting. We would go in and kill the diseased cattle, and if there was not much disease we would go on. But we learned by experience that that was wrong, that we must do something, and we began to increase the expenses and the work in that line. And for the last four years, at least, we do not allow any place to be left until it is thoroughly and effectually disinfected. We find it very expensive, yet we curtail the expense somewhat by taking into account the condition the animal was in when destroyed. For instance, as the Doctor has explained to you here today, an animal in a certain stage of that disease has not communicated it to any other animal and has not left any germs, probably, in the tie-up or barn. If we find an animal but slightly diseased we do not spend as much money in disinfecting as we do where the animal is badly diseased. We have had cases where we have even burned the barn. One stable in Portland we burned, on account of glanders. We very often expend fifteen to twenty-five dollars in disinfecting stables and we are more particular and more careful about that line of work than

we formerly were. I believe it to be just as important to disinfect the stable as to take out the cattle.

Ques. Will you please tell us about the testing of cattle brought into the State?

Ans. Previous to two years ago our custom was to accept tests from veterinarians from the state in which the cattle were bought. For instance, if a man here would buy a lot of cattle in New York, a New York veterinarian would test the cattle and send the test sheet to the commissioners, and the commissioners would accept it; and it was the same with all other states. But the commissioners felt as though they did not always get an honest test. They had destroyed several herds and had traced the disease back to New York or Massachusetts, and found that the animal must have been diseased when it was shipped into Maine. Two years ago they laid the matter before the Dairymen's Association, and this association went before the committee on agriculture of the Legislature and advised a new law, providing that all animals that were brought into the State for breeding purposes should be tested by order of the Maine commissioners within thirty days after arrival. As soon as the law was approved we commenced on that line of work (a year ago last April) and the first year we killed twenty-three cattle that were brought in from New York, Massachusetts, Pennsylvania and other states, and which were diseased when they were brought in here. They had been tested in those states and passed the test, but we killed them and they were all found to be diseased.

This is the most important part of the law under which the cattle commission is working. During the last three years we have come in contact with nearly every important full blood herd in Maine, and we have killed 186 out of almost 1,000 that have been tested, and I think we have made a starting point on the pure blood cattle. I hope the gentleman here from New York has something that will stop tuberculosis from increasing. The commissioners will hail with joy anything that will prevent tuberculosis among our cattle. We have a herd in Maine, in which twenty calves have been vaccinated to render them immune. The man has facilities and he has a valuable herd, and the commissioners advised him to try this method and find out

if there was anything in it. Probably we shall have the calves in half a dozen herds immuned within the next six months. If there is anything valuable in the country in this line, Maine is going to adopt it as soon as anybody.

THE INDIVIDUALITY OF THE COW.

By R. W. ELLIS, Embden.

I am more or less known to every person present, and you all know, who know anything about me, that all the talk that I have ever made in the State on agricultural matters is from my own experience. I have never theorized. And the same will be the case with what I shall say to you today.

If we had not lost our old herd because of tuberculosis and had to replace it with a new one, I should not have been here today talking of the individuality of the cow. We had been breeding Jerseys for thirty-five years. A large part of the time we bred for quality, almost regardless of quantity. We got a very rich herd, I presume as rich as any in the State. We had not had a cow for twenty years whose milk tested less than five per cent, and the average was about six per cent. But they were small yielders. They gave from 3,500 to 4,500 pounds. Once in a while a cow would give about 5,000 pounds, but very seldom. They averaged in butter right around 300 pounds. One year the twenty cows made on an average 316 pounds each. We always had a scale in the barn, and a milk tester, after these came into use, in the milk room. We weighed our milk very frequently and tested it quite often, so that we knew what every cow was doing.

When we lost that herd and came to replace it, we found that things had changed very materially. We had a better looking herd, their udders were larger, they gave more milk. I bought the herd mostly in August. We milked them along until January, then we commenced to weigh the milk at every milking and record it. We have made but one thorough test, which was the first of last August. That test was a revelation to me. I had come to believe, in all these years that we had kept the

Jersey cows, that there was not a very great discrepancy between cows. In our old herd there was quite a uniformity. We hardly ever had a cow that would make less than 250 pounds of butter per year, and from that up to 350. But these cows varied greatly in the test. The cow that almost everybody would pick out as the best cow in the lot tested only 3.5 per cent. I was completely surprised. One of the cows that from all appearances would give the poorest milk tested the highest. She gave 6,517 pounds of milk in a year, and made over 500 pounds of butter. The other cow gave 4,220 pounds of milk and made 173 pounds of butter. I had always supposed that I knew a little something about what a cow would do by the looks of her. I never believed that the shape of the cow's face or head or the color of her tail had anything to do with her value, more than to please the eye, but I had thought that the udder denoted something, and the milk veins. I still think the milk veins have more to do with the quality of the cow than any other marks. You cannot tell by the size of the udder but you can tell something by the milk veins. I have never yet seen a cow with large, crooked milk veins that would not give a large flow of milk. But that does not denote the length of time she will give it, or the quality.

I have found out one thing about the individuality of the cow, and that is that I cannot tell what she will produce in any other way than by the scale and test. And I want to say to you that there are a great many other dairymen in the State in the same condition that I am. When I started out to replace my herd I should have been in a bad fix if I had not found that there were lots of other dairymen who did not know any more about their cows than I did, and they were just as liable to offer me their best cows as their poorest. I want to cite a few instances to show you how little I know and how little some others know, about cows. The first cow in our new herd I bought of one of my neighbors. He had a nice herd of cows, and he sent word to me that he had a cow to sell, one just ready to come in. I went down to see him and asked him what kind of a cow she was. He said, "She ought to be a good cow; she came of the best cow I ever had, and she was sired by your bull." I knew the mother well and knew that she was a first-class cow,

and of course I could not go back on the sire. And I must say that I thought she was as handsome a cow as I ever saw stand up. She was squirrel gray, weighed about 900 pounds, was fat and had a monstrous udder. I was captivated with the cow. The next time I went by his house he told me the cow had dropped her calf and was all right, and I might have her for $40. I should have given him $45 if he had insisted upon it. I told my son that I did not see what in the world that man wanted to sell his best looking cow for. When I asked him why he wanted to sell her, he said she was the only one fit to sell. She was very homesick at first and held up her milk, would not give it down except once in two or three milkings, and she soon began to fall off. I do not think there was any day that she gave over twenty-two pounds of milk and in six months she was entirely dry. We thought it was on account of taking her away from her calf, and that we would keep her another year. We kept her over two calves. The last time she calved, last June, we tied her beside the calf and she seemed perfectly contented, but she never gave more than twenty or twenty-two pounds, and now she is entirely dry again. She was not worth, when I bought her, one single dollar to keep for a cow. I do not believe she has made over 125 pounds of butter. That will show how little I knew about cows.

Now, to show how little somebody else knew. I went down to Winthrop to buy a cow. The first man I called on said he had a fair cow, four years old, that he would sell for $26. I looked this cow over and thought she was worth $26, and so I brought her home. She bothered us a long time about getting in calf. She gave milk about a year and a half and then she went dry about four months. Last January, the 14th day, she dropped a calf, and from that time up to the first day of last November, when she dried off, she gave 5,929 pounds of milk and made 473 pounds of butter. The 25th of November, after going dry about four weeks, she dropped another calf, and she was giving thirty pounds of 6.8 per cent milk per day. The man of whom I bought her thought she was the poorest cow he had, and that is what she has done!

The next man I called on was going to sell his whole herd, as he was going out of the business. He said they were all

good cows except one; that one he did not intend to keep, as he did not think she was worth keeping. I inquired of the neighbors and they said he had one of the best herds in the State; he was a man who would not keep a poor cow. I bought them and took them home. They all gave a fair amount of milk. The first of the winter I was in Winthrop and I called up to see him and told him that I thought some of them were better cows than others. He said, "You will find there is not much difference." But I have found that one cow in the lot, about as homely a cow as you can imagine, has made over 500 pounds of butter in a year, while another one, which I have told you about, made only 173 pounds. I do not believe there is a man in this audience who would not have picked out the poor cow for the good one. The one that the man intended to kill made 300 pounds of butter in seven months, and went dry five months. She is dry now, and my son intended to kill her until we tested the milk. She was a cow that had a flabby bag and you would pick her out as giving poor milk, but it tested high.

My object, friends, in speaking on this subject today is to show how little we can rely upon anything but the scale and the tester to determine what kind of cows we have. There are hundreds of men in this State that we call good dairymen, that do not know what their cows are producing individually. You cannot tell the amount of milk without weighing. My cow that gave the smallest amount of milk was giving that milk so frothy that by milking four quarts I could fill the pail. From another cow I could get seven or eight quarts into the pail. I want to say here that every dairyman should know exactly what each one of his cows makes, and there is no other way to ascertain this except by weighing and testing the milk. There are hundreds and thousands of dollars lost by the dairymen, because they do not know what their cows are doing.

HOW BEST TO CHEAPEN MILK PRODUCTION.

By F. A. CONVERSE, Buffalo, N. Y.

I suppose, in the treatment of this subject, what we want to do is to get at something that is absolutely practicable, that is within the reach of every man today, on his farm, as he is situated, under the conditions with which he has to deal. It seems to me the first question to discuss, in cheapening the cost of milk production, is the character of the cows with which the man is working. I do not know the character of the cows that predominate in Maine, but I know the kind kept in New York and some other states, and I assume that your conditions are very like those in other states. I assume that you have cows of all kinds, colors, weights, sizes and conditions. In a way, that is all right. I believe that a man, in the choice of his cow, should, in the first place, select the market that he shall put his milk into, and then get the kind of cow that will produce the milk that the market wants, at the lowest possible expense. A man cannot conduct a dairy business successfully unless he knows something about the cost of production. Every man who is keeping cows should know what it costs him to produce a pound of butter or a quart of milk for the entire year. I do not think it is necessary for a man to weigh and test the milk at each and every milking, but he should do it often enough so that he will know something of the character of the cows. He should know whether this cow or the other is paying the best, and it is only the man who keeps records that can know definitely these things. And it is only the man who can do this who is in a position to cheapen the cost of production. The essential thing is to know just what your herd is doing. You farmers who are not keeping tab on your cows would be surprised to know the actual production of each one of them. A man who has a cow that gives a large flow when the conditions are ideal for milk production, a pail and a half in June, is apt to think that she is his best cow. But did you ever stop to think that then the conditions are all perfectly natural and ideal for milk production? I go on the theory that a man ought to

study to produce milk at the time when it pays him the best, and that is not in June. This business is like all others—if we are to succeed we must row against the tide a little, try to have June conditions at other times of the year.

Now, in regard to building up the herd. Suppose you have a Jersey herd, an Ayrshire herd, a Holstein herd. I am one of the men averse to going outside of that breed to build up the herd. A cross-bred animal is a mistake, because the particular quality we want in the herd we can get within the breed. And then as we breed along from generation to generation, we get a much better animal. The tendency with the Jerseys has been to increase the flow, and with the Holsteins to increase the quality, and we have Jerseys that are big producers as far as quantity is concerned, and we have five per cent Holsteins. Men are succeeding along those lines, within the breed with which they are working. So I say, select the breed you want, according to the market to which you are catering, and then have the very best of the breed. You say that that is expensive and your pocketbook will not stand for it. So we will begin with the herd exactly as it is, and try to improve it. We will know, in the first place, what the animals are doing. We have in mind the type of cow we want, and we are to work towards it as fast as we can. In relation to the breed, suppose you have Jerseys; they come from a place where the climate is almost eternal summer. I wonder if you treat those Jerseys as they are treated in their native country, or anything approximating it? I have seen Jerseys up in northern New York or northern Michigan, and they were out traveling three-fourths of a mile to drink ice water, to toughen them. Put it down as a rule that with any cow that has been bred for a distinctive purpose, under certain conditions, when you violate those conditions you do it at your loss. The Jersey was not built for that sort of treatment. The Swiss cow all her life has been going up and down the mountains. She has a foot built for climbing the mountains. She is muscular, strong, a reasonably good milker. The Jerseys and Holsteins have been brought up where they have not had to move very much to get all they wanted to eat. Many times we bring them over here and use them as we would use a native. I do not believe that is the right thing to do, from the dollars

and cents standpoint, and I am discussing this question simply from that standpoint. How are you going to improve the herd you already have? You may know that I am an Ayrshire man. The Ayrshire is a happy medium between the Holstein and the Jersey, a cow with a wonderful constitution, a cow bred for work; no better than the Jerseys, no better than the Holsteins or some of the other breeds, but a good cow. Time and time again men have gone into our stables to buy a bull. There would be ten or a dozen bulls for sale at different prices, $50, $75, $100. Now these men think that a bull is a bull, and the rank and file of them will buy the lowest priced animal. What is the result? Here is a bull for $50 from a cow that will give 4,000 pounds of milk testing about 3.3 per cent; and you can buy a bull for $100 from a cow that will make 6,000 pounds of milk at 4 per cent, and so on up. Is it not a fair supposition that the man who invests $50 or $100 more in a bull from a cow that will give twice as much milk and has a record back of her for generations will improve his herd faster and better than he can to buy a low-priced bull from a cow with a small production? I have said that I hope to see the time come when we shall have a national law that on no farms in this country can there be any other sires used than thoroughbreds. Canada is setting us an example. We are breeding from any scrub stock we happen to have. In our state at many of the fairs premiums are offered on grade sires. This is wrong. No man should breed from a grade sire.

Now, then, if your herd is deficient in flow, breed from a sire that will make up that quality. If it is deficient in quality, breed from a sire whose tendency will be to build up in that line. Breed from a sire that has a good constitution, that is rugged, that is prepotent. That will give you the standard for which you are striving. There are a great many men who say, "I do not take very much stock in that, because I can handle a bull and feed him and care for him, and in a generation I can change the character of the animal." Did you ever hear a man talk like that? He is wrong, friends. Back of it all you must have the blood, the type, the prepotency, if you are to win, and that does not come by environment or feed or care. It is an inherent quality in the animal that no man can put there arti-

ficially, but we can increase and help it along very much by our intelligent feed and care, and that is something we want to do.

Now, what are your herds averaging? Any man who has a herd that gives 4,000 pounds of milk ought not to be satisfied. He should set the standard a little higher the next year, and when he has reached that, the following year he should raise it a little more. A man told me he had a cow that would give a fraction over twenty-two pounds of butter in seven days. I said, "If you had a herd that would do that you would be satisfied." He said no, he would want to get it up a little higher. Every man has a few animals that excel, but the trouble is that he does not know which they are. Now, weed out the poor ones. Raise your own calves. If you buy them of some other man you pay for his education and brains, to get your herd up to a higher standard.

In reference to the feeding of the cows, I believe that in the dairy business the sooner we cut off the feed bills we are paying to the western dealers the better. The nearer we can live within ourselves the better. The more food we can raise on our own farms, that is adapted for milk production, the better. That leads me to say, if we are going to raise our own feed, we must have a short rotation of crops best adapted to feeding the dairy cow for the production of milk. And I say unhesitatingly, if a man is to do that, the rotation of crops will be clover, corn, oats and peas; a three-years rotation. With these crops a man can run his herd and go into the market and buy very, very little grain, and that only of the most concentrated sort, worth almost as much as a fertilizer to spread on the land as it costs as a food. I suppose most of you are raising those three things. It is a common practice in our own state for a man to seed down to clover, and then he will say that the clover runs out. His idea seems to be to keep the land in grass as long as he can, until it cuts only half a ton to the acre, and then turn it over. Friends, that is all wrong. The Lord made the clover plants to run out. Your corn runs out. No clover ever comes in except from the seed, hence it does run out: and when it runs out, if a man is keeping dairy cattle he does not want to depend on timothy hay if he can get clover. I was telling a gentleman on the train this

morning a little experience I had in Michigan a few years ago. I was talking to a large audience on the question of clover and one gentleman in the middle of the hall got up and said, "I move we discontinue this subject. We have raised wheat for a long time, and we all know it is absolutely impossible for us to raise clover." The chairman was somewhat nettled. He did not want to be discourteous to me, and hardly knew what to do. I said to the man, "Do you say that you cannot raise clover here?" He said, "No, sir; there has not been a good catch of clover within fifteen miles of this place for the last fifteen years." I started in with the discussion and pretty soon that man came up the aisle shaking his fist. I said, "Look here, I want to say to you that if you cannot raise clover right here on any ordinary farm you have, the trouble is not in the soil or the atmosphere, it is right under your hat." Two years after that the man came into my office in Buffalo and said that that talk was worth $20,000 to the men who heard it. He said, "I own two farms outside of that town, one of my boys is on one of them, and another on the other. We followed out what you said about the clover, and we have about as nice a piece of clover as you ever saw." Now, if you do not raise clover, the trouble is with yourselves. In raising clover, to get the most out of it, you should follow a short rotation. Cut the hay as green as possible; most men let it get too ripe. Did you ever see a man who was raising a calf, and feeding for milk production, that did not like rowen? What is the matter with making rowen out of the whole crop? Begin to cut your clover when not more than half of it is in blossom. You cannot cure it quite as fast, but you can cure it, and then you will get a good second cutting. The next winter, manure that piece and turn it under for corn, and keep that right up, following a short rotation. It is more work, but you will get more for it. You will get a better feed than you can get in any other possible way. And if possible, we want to cut off those feed bills. The farmers in our state will draw their load of milk up to the creameries and then go over to the feed store and draw back the feed, and when they come to strike a balance at the end of six months or a year, as the case may be, about all of the money they have made the feed store has taken. In my humble opinion, friends,

that is wrong. You can raise a ton of oats and peas on every acre, in grain, and a cow that has a ton of grain fed to her judiciously through the milking period is pretty well fed, as to grain. You may have to balance that up a little, and if you do, simply go into the market and buy those feeds that are worth almost as much as fertilizer as for food, like gluten feeds and cottonseed, some of those nitrogenous foods; but never exceed two pounds of the concentrated food in a ration. I have met men who are feeding as high as six pounds of those concentrated feeds, but in my opinion they are making a great mistake.

I am going to say a word about oats and peas. You should put those in as early in the spring as possible. I find by talking with some gentlemen who raise their own feed that there are localities in which it is impossible to raise peas, but I conclude they can be raised here. The value of oats as a food I do not need to mention. The chemist can analyze coarse bran and oats, and the analysis may not show any more feeding value in the oats than in the bran, but you and I know that if we are driving a horse there is nothing that fits him like oats. They have a certain nerve-producing, energizing value that the chemist cannot get at, and that is just as valuable for the milch cow and the laying hen as it is for the horse. I do not know why it is so, but you who have had experience know that this is a fact. So added to the value of the protein feed you have the energizing value of the ground oats for the milch cow that you cannot duplicate.

Now, then, you are shy of protein. We think we have to go into the market and buy the protein of our foods. All our hays except clover contain mostly carbonaceous material, our corn is starchy, so we have to balance these up. Hence we put the peas in with the oats, then we have the protein added and we have very nearly the kind of ration that we want, raised on our own farms. One acre of oats and peas, seeded two bushels of oats and one of peas to the acre, will supply a milch cow during her milking period very nicely, and we have cut off one-half to three-fourths of the feed bills, which it seems to me is a great advantage. For many years we have reduced the concentrated grain fed to the cows, in that way.

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I should, perhaps, say just a word as to the time of cutting the oats and peas. This should be done when not more than one-third of the field is turned yellow, and they should be cut with a mowing machine, and treated and cured as hay.

It should be borne in mind that handled in this way, the feeding value of the straw is about equal, ton for ton, to ordinary late cut hay. It is also a fact that the grain cut in this period of growth will be plumper, and weigh more pounds to the bushel, than if it were left to get fully ripe.

When the crop is removed in this way, ordinarily the last of July, seed with clover, about six quarts, and two quarts of timothy to the acre. This seeding will go into the winter as large as if it were sown with the crop early in the spring.

This also enables one to run a weeder over the oats and peas four or five times, until the crop is a foot high, thus conserving the moisture, and killing the weeds.

There is no form in which you can raise food value as cheaply as you can raise it in ensilage. It is not my province to discuss the question of ensilage further than to say this: You know in the summer you do not like to feed your cows timothy hay because they do not do well, and yet a chemist will analyze grass and timothy hay and find they are the same thing, only more water in one than the other and the proportions are different. You and I know the value of them as food. The man who, during the six months that his cows are housed, depends on the hay, does not get succulence enough, does not get that element which is in the grass, unless he has some kind of a succulent food, and there is no succulent food that you can raise as cheaply as you can ensilage from matured corn, sowed thin, cultivated cheaply, and stored as you know how to store it. A good silo will pay for itself the first year, in the excess of food value that you will have by taking care of your corn in that way as against the ordinary method of curing it. This question of succulence you cannot lose sight of.

Another thing, in the cheapening of milk production we must follow this short rotation, and keep it right up. Suppose some time your clover does not catch, there are other crops you can put in, as millet, and I am not so sure but alfalfa is going to help us out on this proposition. I believe you can raise alfalfa anywhere that red clover can be raised. There is the same

trouble with it that farmers have with red clover, but it is coming. The alfalfa plant comes from the West to the East. I notice more of it in my travels than I used to five or ten years ago, and it will not be long before you will see it all over the dairy localities, and it comes as a splendid substitute for red clover, with double the amount per acre.

We have raised the clover, the corn and the grain, and now must come the care. I said a moment ago that we could produce milk the cheapest in summer. That man who approximates the nearest to summer conditions as to feed and care, other things being equal, produces his milk the cheapest. I wonder if in the majority of the stables belonging to the men within the hearing of my voice the conditions are like June today? That is what we want, friends, June conditions. There is no picture of contentment that so delights the artist as that of the old cow filled with grass stepping up to a cool spring and taking a drink of water, then lying down in the shade and chewing her cud, making milk for her master. A picture of absolute contentment. I have been in stables where the picture did not look that way in any particular. In the first place, the cow did not have enough to eat; in the next place, she was in a filthy condition; and in the next place, the air was extremely foul. I hope none of you that are here have those conditions. So, I say, the stable should approximate June conditions, and the cow should be tied with some kind of a tie so that she has her liberty. Col. Curtis used to say, "If a man thinks a rigid stanchion is good for a cow, my advice to him is to stick his head between two pieces of board and keep it there twenty-two hours out of twenty-four, and judge from his experience." You can put two cows into a good stable with the conditions exactly alike, and the cow with an easy stanchion and loosely tied will give more milk than the one with a rigid stanchion. Anything that aggravates a cow tends to lessen milk production. We never appreciate as we ought the highly nervous organization of the cow that is giving a lot of milk. Her function as a mother, her work as a phenomenal milk giver, what a tax it is upon her! And how we ought to care for her, almost as one of the family! And yet the rank and file of men do not appreciate that fact. But that is the lesson we have to learn before we reach the highest success in this line.

So much for the feed and the environment. Now what about the character of the goods you are going to produce? What we want to do is to strive to produce the best possible article, and to produce it in such a way that when we put our brand on it and it goes to the market everyone is seeking to get that brand, because it is A 1. Every man can build up a reputation that will be money in his pocket, if he will work on that principle. I am a city farmer now; but all my life I have plowed and milked. I have been in a city for the last five years. I have a farm; I have a dairy. But in my business in the city now I am thrown not so much among farmers as among business men, and the rank and file of those men in the city, when you speak of a farmer, think of him as some fellow who is going to put little apples into the middle of the barrel, or put water into the milk, or something of that sort. There are more crooked fellows in the city than in the country, there is no question about that, and yet that is the opinion many business city men seem to have of the farmer. What we want to do is to produce goods of such a quality that they are praised wherever they go. I am inclined to the opinion that a man can produce milk in that way, with selected cows, fed from the crops he has raised on his own farm, with a judicious marketing of the milk, so that he can almost add 25 per cent to the net revenue he is receiving at the present time. I would not be satisfied until every cow in the dairy was making at least 7,000 pounds, and until I had made that milk at a cost of 75 cents per hundred or less. When you set up those standards and work for them, it will not be long, if you have that determination you ought to have, before you will succeed, and you will produce milk in that way, because the situation is absolutely in your own hands. I find some men who come to the dairy meetings and farmers' institutes, and then they say, in regard to the speaker, "That is all right for him; undoubtedly he has a good bank account back of him." But, friends, I do not think I have given you any method that it is not possible for any man in this hall, whatever his circumstances may be, to go back to his home and set in operation. It will not cost him very much; it is something that appeals to everybody. I think that you men can work it out along that line if you will.

As I go through the different states, and as I meet the farmers everywhere engaged in the different lines of dairy work, fruit

culture, etc., my observation is that there is a work going on, of improving the conditions. You know that in every community, in every little locality, there are two or three, or more, people who are working along advanced lines, and when you find a man who is using those improved methods, the spirit of the community towards that man is not always what it should be. I tell you that you and I, as American farmers, want to get over the idea of pulling down and finding fault with the other man who is doing different from what we are and succeeding better. All hail to the man who is a success in a community as a business man! We ought to take him by the hand and bid him God-speed and help him along. If you have five such men in a community, pretty soon you will have ten, and pretty soon you will have more. There is a feeling in the community that is an uplift to every young man. I was out in Nebraska a while ago, and something was wrong with the engine so the train was held up for a while. We pulled into a town with about twenty shacks, and I would not give $40 for all the buildings. It was August, and everything was very dry; the ground fairly burned one's feet. We staid there about three hours and I, with a lot of other men, was walking up and down the place, when I asked one of the inhabitants how long he had lived in that God-forsaken place. He looked at me sharply and said, "You are a downeaster, aren't you?" Then he began to talk about the place and I never saw a man in my life stand up for his town and his business as that man did. I never got such a rebuke in my life. And from that time on you would never find me running down my town or my locality.

REMARKS OF Z. A. GILBERT.

Dairy authorities and dairy journals have been giving us the very sensible instruction that the way to retain to ourselves a larger part of the income from our cows is to reduce the cost of their feed. The two leading factors in the problem of low cost milk, among the many others that enter into the account, are, first, good cows, and second, cost of feed. In the time assigned me this afternoon I propose to confine myself to these two points only.

The importance of good cows, if the business is to be made profitable to any degree, commends itself and calls for no argument in its support. The only question on this point is how to get the good cows so necessary to the success of the business. On that problem there are just two ways open for action; one is to buy them, and the other, breed them, and many men in the dairy business find the course first named the easier, if not the more successful course to take. Many dairymen are in the practice of picking up select cows from other herds, wherever to be found, and in that way keeping up a higher producing average of the herd than through breeding alone. Whichever the course taken, there never are enough of the superior cows to go around and meet the demand of all who want that kind. Hence the search for superior cows is always on, and likely so to continue for an indefinite time to come.

Some scientific men try to get around this mountain barrier in the way of a larger supply of the superior cows that all dairymen are so much in need of, with the simple injunction, "Breed to a pure bred bull." Just as though that was a solution to this great problem! If such instructors would stop by the way long enough to consult Brother King and Brother Keene, and wait half a lifetime for Brother Pember to work out his experience, they would learn that the injunction to get a pure bred bull is but a small measure of the requirements called into action in breeding up a herd of cows superior to those we now have.

But I do not purpose to dwell on this first factor of the problem under consideration, but proceed directly to the second factor, the relation of feed to the cost of the milk product. It is a truism that need not be repeated that cows must be generously fed in order to respond liberally at the pail. It also fol-

lows that the lower the cost of generous feeding the wider the margin of profit on the milk produced. This leads directly to the question of cost of the feed consumed. It makes a wide difference in the balance at the end of the month whether the feed cost is high or low. I maintain that in a broad application the way to provide the feed for the cows at low cost is to grow it on the farm where the cows are kept. Even a good cow has no superior value to her owner unless she can be fed at a profit, and any one can readily see that the margin of that profit is no more measured by the amount of product furnished in the year than by the limit of cost of feed that produced it.

Before proceeding further on this point, it is important that we have a common understanding of the term "cost" as applied to fodder products on the farm. Many times there is a wide distinction between cost and value, and in some cases this difference has led to erroneous figuring, and therefore to unsound conclusions. The cost of fodder products to a farmer on his farm is the outlay in money or its equivalent involved in placing them there, whether purchased from outside or grown on the farm. In so far as the productions of the farm are concerned, the cost has no relation whatever to the market value. In the case of purchased grain brought to a farm, the market value, with something added for handling, becomes the cost to the farm.

I maintain that the clovers and the grasses are the lowest cost fodder material that can be supplied to our cows. To the extent, therefore, that the grass crop, green or dry, can be utilized for the feed of the cows, to that extent will the resulting milk product be cheapened. The fact is, we have been overlooking, in the past ruling low prices of the grain feeds, both the feeding value and the possibilities of production of the grass crop. The day of low priced bran and gluten is gone with the past, while recent experiments in grass production are opening our eyes to the feed value of the grass crop as compared with other fodder crops. On the strong soils of nearly all our Maine farms I make the claim, without fear of successful proof to the contrary, that valuable, digestible, nutritious material, suited for cow feeding, can be produced and laid before the stock at less cost in the form of clover and the grasses than with any other crop suited to our climate. Then, these mixed grasses as usually

grown, green or dry, make up a balanced ration, or a ration so nearly perfect that cows will thrive and keep in good condition while giving a liberal flow of milk with but a small addition of grain feed. Taking this into account, therefore, that substantially as many pounds of this valuable nutritive material can be grown to the acre as of any other crop known to our agriculture, that it is a perfect feed, and that it is produced at small cost, it is easily seen that in the production of low cost milk it holds a leading place and may well receive more appreciative attention as related to the question under consideration at this time.

Further, I have said that the grasses in their fodder forms—and I mean if handled in their proper form—when handled from the standpoint of low cost milk require the addition of comparatively light and inexpensive grain feed, and I claim that this needed grain feed can be produced on the farms where needed at less cost than by purchase from the market, as is the common practice with dairymen.

Oats are adapted to our conditions of soil and climate, and can be produced at reasonable advantage by any farmer wanting them for use. They are also a grain feed that well suits the deficiencies of the crop we have been talking about. It will not quite balance the scientific ration, but will leave a balance in the pocket of the operator which is very satisfactory.

REMARKS OF CHAS. D. WOODS.

It certainly gives me great pleasure to look the Maine dairymen in the face again. I have been much interested in the discussion of the afternoon, because it is a very vital question, and, as those of you who are producing milk have been learning from your experience, it is an increasingly important question. Not only the question of the price of purchased grains, but where the purchased grains are to come from, especially these by-products that we have been using, is going to be more and more embarrassing each year. I have very great hopes that one class of feeds may be increased. If in running this machinery that is on exhibition here we get to using alcohol instead of gasoline, we shall make it from corn, and that will throw upon the market a large amount of distillers' grains, which are practically gluten feed. The only hope that I can see that we have in the future is that these by-products that we have been using so liberally in the past will be reduced in price. I want to say amen to everything that has been said here about growing grain, grass and clover on the home farm. There is a large portion of our State in which corn can be grown. We are pretty near the northern limit of the corn crop at Orono, and we have not failed to make silage of pretty good quality in any of the ten years I have been there, so I think we can safely count upon that quite largely in all of the section of the State which lies south of this point, or south of Waterville.

There are two things that I would like to say during this Conference, and I think this is as good a time as any to say them.

First, after we have grown all of the home feeds that we can, many of us will still feel that we must purchase concentrated commercial feeding stuffs, and I want to make the appeal that I have made to you so many times. I have never written a feeding stuff inspection bulletin but I have tried to bring out this point: When you go to a store to supplement the home grown feeds, you go to buy one constituent only, and that is protein. You do not go there to buy so many pounds of grain. If you have been managing your farm at all as you ought to manage it, you have grown all the carbohydrates that you need. And when you come to supplement the feeds, you must buy feeds rich in

protein or that will give you protein at the lowest possible price per pound. We are great consumers of breakfast foods of various kinds, and in the manufacture of the breakfast foods we accumulate a large amount of hulls like oat hulls, and these come into the hands of the great producers, and some of these producers have great stocks of oat hulls which have just about the same feeding value as oat straw, which they want to sell. They will add more or less of other concentrates to these feeds, and put them upon the markets with enticing names. You are not wise if you buy them, when it is protein that you want. Cottonseed meal is not of as good quality as it used to be. It probably never will be of as high quality as formerly. There is a larger demand, and if the dealers can sell cottonseed hulls at the price of the meats of the cottonseed, they are bound to sell it. I doubt if we can count on getting more than 41 per cent protein now when we used to get 44.5 and occasionally 47 or 48. We have analyzed a good deal of cottonseed meal this fall that carried 38 per cent protein. Suppose it has 40 per cent; you buy a ton and you get 800 pounds, and this 800 pounds of protein has cost you $30 a ton in the cottonseed. The protein has cost you, then, 3¾ cents per pound. You go to the store and buy an oat feed which we will assume will carry 12 per cent protein and if you pay $18 a ton for that your protein is costing you 7½ cents per pound. So in the oat feed your protein is costing you twice as much per pound as in the cottonseed meal, even at $30 and not of as good quality as it used to be. If you are interested, send for our last feeding stuff inspection bulletin, which has an article along this line.

There is another thing I want to say: We have had a feeding inspection law in this State for years. We were the first State to adopt a feeding stuffs law: all the eastern states now have a law very much like ours. The result is that practically all of the feeding stuffs are sold on their merits today; and in order that you may be sure that you are getting what you ought to get when you buy a feeding stuff, particularly when you do not know very much about it, open the bag, stir it down to the depth of a foot, take out about a pint, put it into a tin spice box or something of that kind, and put your name and address on it and do it up and send it to the Experiment Station, and we will tell you, usually within 48 hours, exactly how much protein it

carries. Fortunately, protein can be very cheaply determined, hence we can make this offer to do this free to all who send us a sample, dealers or consumers. If you are not getting what you buy, you are to blame. When you go to the store to buy grain, it is protein you are chiefly interested in, and if you have any doubt as to the nature of the feeding stuff send a sample to us and we will tell you.

BUILDING UP A DAIRY HERD.

By E. F. Pember, Bangor.

Our presence here in this meeting assumes that we are interested in the dairy business; yes, more, that we have full confidence in the dairy cow to improve our farms, pay us for our labor, and give us a good profit upon our investments.

The conditions peculiar to a Maine farm have long since convinced us that first-class *dairy* herds are what we need. Possibly in some section of our State beef cattle may be grown at a profit. If we can find farmers with time and patience enough to do their work with oxen, and later turn these for beef, we can understand how it will pay to raise this kind of cattle. But the majority of us prefer to depend upon the dairy cow, and the splendid market we have for her milk, cream and butter. And I trust further, that the members of this association are not deluded by any "dual purpose" dream. In point of fact the "dual purpose" cow does not exist. Some may claim this for certain of the larger breeds, but it proves to be only a dream and a delusion when put to the test.

All of the progressive farming, of these later days, makes the dividing line all the more distinct between the beef and dairy breeds. Prof. Burbank may grow an apple that is red and sweet on one side and yellow and sour on the other, but the farmer has not been found who can produce a herd of cattle that shall lead in both dairy and beef products, at the same time. In these days of wonders it may be too much to say that this can never be done; it is safe, however, to say that this never has been accomplished.

Of course any healthy cow may be turned into beef, and her progeny into veal or beef, while such milk as she gives will produce cream and butter; and this might be true of any "scrub" cow in existence. What we mean is this—no farmer has any right to expect ideal milk and beef production from the same cow. The very food we furnish will not make the most beef and the most milk at the same time. Which do we wish to produce? I assume that we are not trying to break the beef trust, but we do aim to have the best dairy herds, and make as much money as we can.

With this ideal in view, I am going to try to tell you how to build up a dairy herd. Let us take the conditions as they are. With perhaps a score of exceptions where pure bred herds are kept in our State, our dairy cows represent an indiscriminate mixture of every known and unknown breed in the dairy line. And for fear that the variety should not be great enough, even the well known beef breeds have been called upon to make the chaos all the greater.

Ask a farmer what kind of cows he keeps and he replies, "Oh! just plain cows, any kind that I can buy," and if you were to see his herd you would easily believe that he told the truth.

Of course every farmer cannot afford to buy and own a pure bred dairy herd. This, however, is the thing that ought to be aimed at. It costs no more to keep and feed a pure bred cow than it does the commonest "scrub," and it would pay us far better in the end.

Holland, the Island of Jersey, or Guernsey, or the Highlands of Scotland give full proof of this. When we want an ideal dairy cow we go to one of these four localities and import one. If they were content to mix things up the way we do, their profitable sales would cease.

Remember, I only say this is the *ideal* and that we should not be satisfied until every cow in Maine is a pure bred cow of some sort.

Still, I am willing to ask that we simply do the best we can under all the circumstances. First, therefore, let me insist that every dairyman shall select the dairy breed that suits him best. He has four prominent ones from which to choose: Ayrshire, Guernsey, Holstein and Jersey. (I name them in alphabetical order, and not necessarily in the order of personal preference.)

Climate, the food he is prepared to furnish, the kind of a barn he is going to keep them in, the market he has for his milk, his own personal taste, and many other reasons may enter into the problem. But I say, consider all of the facts and then decide which dairy breed you like the best. This decision may mean more than you think, so do not hurry about it, but as soon as you can, *decide*. When you have made your decision, purchase as promptly as possible a pure bred registered pair or trio, and with these lay the foundation of a pure bred herd for yourself. If you cannot afford to take so long a step at first, purchase a registered sire and with this sire grade up your herd as well as you can. Be sure to get a calf from a cow with a good record of production. Remember that the sire you use is one-half of your herd; and it is the poorest possible economy to own or use anything but the best that you can find.

Personally, I would welcome the enactment of a law making it a penalty for any farmer in Maine to keep or use a "scrub" bull. It is not economy, but a crime to use a sire that will sow seeds of degradation from which a herd can not recover in many generations.

Understand, I am not pleading for the use of any particular breed; but I simply insist that no sire should be used that is not pure bred. Then be sure to get the very best you can find of the breed you have chosen.

The next step in grading up a herd is to be sure not to in-breed. Some may try to justify this procedure, but the smaller size and weakened constitution of many of our cattle positively forbid anything of the sort.

When you have heifers old enough to breed, purchase for them another sire. Get the very best you can in the breed you have begun with. Don't let anybody persuade you to change, unless you sell your herd and begin all over again. Stick to your ideal, and make every year show a decided improvement in your herd.

The first year will give you half blood calves, the next generation will be three-quarters, and when the third, fourth or fifth grade has been reached, it will be difficult to tell them from pure breds. Of course they can never be registered, but for all purposes outside of breeding, they may show splendid results, and prove themselves to be of great profit to their owner.

Another step toward success in building up your dairy herd, do not breed any heifer until she is nearly or quite two years old. Let the heifer grow and make her body as large and her constitution as strong as she can before the demands of motherhood and of a milk producer are placed upon her.

I realize that there are those who will tell us that the dairy qualities will be lost or injured by this delay. Nonsense! You have only to see the injury that has been done by breeding too young. You have only to notice the weak, frail, undersized creatures, in the average farmyard, that they call cows, and realize how easily these are subject to tuberculosis, and every other ill that bovine flesh is heir to, when the full importance of my claim will appear.

The leading cause of all this trouble is breeding the heifers too young, and the balance can be charged to in-breeding. We need not make either mistake. Whichever dairy breed you select, do not in-breed, and do not breed any heifer under two years of age.

If a farmer will follow my suggestions, in a very few years he can transform his mongrel mixture of cows into a respectable looking, and profitable dairy herd.

If he started with a pair or trio of pure breds, he will soon be able to sell his grade cows, and own an entire herd of registered cattle, with only the cost of his first purchase. This is no dream, but a possibility within the reach of every intelligent, industrious farmer in our State.

I do not overlook the fact that many other things must of necessity enter into this worthy task of building up a dairy herd. The food and care bestowed upon a herd forms an important part. And I can not help feeling certain that if we can persuade our farmers to keep better cattle, they will take better care of them. The moment they begin to look with pride upon their herd, that moment they will plan for a better barn, subscribe for a farm paper and learn how to feed so as to obtain the best results, in a word take better care of every creature they own.

Kindness as well as cottonseed meal will count in the care of your cow. A good brush is better than a milking stool or a pitchfork to start the dust, and make the cow comfortable. Cruelty and profanity may largely counteract the effect of a proper amount of protein. An unbalanced temper may spoil the result of a well balanced ration.

The delicate business of a dairy cow demands that those who care for her shall be as kind, gentle, and quiet as possible. This is perhaps even more true of pure bred stock than it is of *scrubs*.

The cleaner and more perfect the breeding of a cow, the more sensitive she becomes to ill treatment, and the quicker she responds to kindness and attention.

It is not the kind of food alone or the amount that is fed, that makes the herd sleek and contented. Mark you! kindness, a comfortable bed, and a clean barn will do much.

I was much interested, recently, in a picture that appeared in "Hoard's Dairyman" entitled "Two Ways." This picture taught a lesson worth remembering.

If we would improve or build up our dairy herd we should be continually selecting our best. Every progressive dairyman should learn the necessity of picking out and disposing of the poor or unprofitable cows. There are many cows even in pure bred herds that are only worthy of being sent to the butcher's block.

Nothing will prove a safer guide in this weeding out process than to weigh the milk, and test it for butter-fat. I am very sure that if we could persuade every farmer to make these tests, there would be a large number of herds for sale, and the demand for pure bred stock would be even greater than it is today.

One thing more,—we must look well to the health of our dairy herd. We cannot afford to use or sell milk that comes from a cow that shows any form of disease. We can buy healthy cattle, and we can largely keep them so, if we will supply pure air and sunshine as well as good food and water. I had a pleasant call the other evening from a doctor who was prepared to furnish us with a "*Bovovaccine*," that is, he claimed to be able to vaccinate our calves when under three months of age and make them immune to the dread disease *tuberculosis*. The day was when people did not believe it necessary to vaccinate children to prevent smallpox, but experience has made many converts.

Possibly science is ready to protect our cattle, and in a few years make it impossible to find tuberculosis in any vaccinated herd. Would we not all hail with joy the coming of such a day! May it come speedily!

In conclusion, I say what might have well been said first. Success in building up a dairy herd will depend very largely upon

the love and interest you put into the work. "What!" some one says, "Shall we love our cows?" Yes, most certainly, if you are to succeed in your aims and make the dairy business profitable.

If you don't love flowers they will not grow for you. If you don't love your cows, they will not prosper, because you will not have interest enough in them to look after their daily welfare. It will take your love, your interest, your time, your talents, all of the skill and energy necessary for success in any business.

If you are willing to pay the price victory is yours.

REMARKS OF JOHN M. DEERING.

It would be useless for me to undertake to interest you in anything I can say in relation to breeding up stock for a dairy herd, after the subject has been covered so instructively by Brother Pember, and also by Brother Gowell this morning. The discussions all through the day have been chiefly upon breeding, and it would seem as though you had had about enough of it at one meeting. Perhaps, as a change from a well prepared and scientific paper, it might be as well if I should give you a little of my practical experience within the last few years. I wish to say to this audience that I have been a breeder and a farmer and a cattle dealer and a cattle commissioner, all my life. Years ago I used to breed cattle, and I want to illustrate a point by telling you about a little herd of cows I raised 25 years ago. When this country was first settled occasionally pioneers would bring a cow over from England, and the breed was Devon. Why did they choose those Devons? Because they were a hardy breed and could stand the cold winters and the privations the settlers had to endure in those days. The Devon breed predominated in this country for over 100 years, and then the demand came for a larger breed and they began to import into New England a few Durhams. The Durhams in those days were not what the Durhams are today, they were not so large. A few of those were imported and they crossed them up with the Devons, and that breed of cattle predominated until 1890 in New England. Those cattle had a pedigree; they were not mixed up with all kinds of blood, they were a straight cross between the Devon and the Durham. Now I was in the same business that I am in today, I was

keeping cows and producing all the milk I could, and I was breeding up a few cattle. I bought a full blood Durham bull and raised up a herd of 40 cows from that sire, and I am going to stand here and say that it was as good a herd of cows as I ever owned in my life. Unfortunately, they were burned up and I lost that breed. Then I commenced with the Holsteins. At that time there were but few of that breed in this section. A young man bought a Holstein sire and brought him into the town and I gave him $30 for 20 calves, and raised them. They were nice looking calves but when I got them up to cows they were not good for milking purposes. I was disappointed in them and turned them away for beef. But another sire came into the town and we patronized that one and finally I bought him and we raised up another herd of grade Holsteins and there was not a poor one in the whole lot. Everybody had a good cow who patronized that sire, and that blood still exists in my neighborhood and town. They were fine, beautifully shaped animals. Generally the larger the cow the poorer the quality of the milk. That first sire was from the Aggasiz family, a great large fellow; the other one was from the Mercedes and it was a compact built animal. The Holstein people saw that they were breeding their cattle too large. The quality of the milk was not good enough. They began to breed for a better quality of milk and began to run the size down a little, and today the Holstein cows are better cows for milk than they were 25 years ago—for quality, not for quantity. What was done with that Durham and Devon cross of cattle? In 1890 a depreciation in the beef growing interests struck this country, and farmers could not live by raising beef. They did not turn away those beautiful steers for cows because they wanted to, they did it because they had to. The time the beef growing interests were the hardest in Maine was the time just after the West was settled and eastern money had gone out there, and the ranches had been built up and cattle had been bred until there were 1,000 cattle to every 100 inhabitants. That was too many, and the price went down. We had no foreign markets and we could not handle the beef products of the country at a high price. Hence the farmers of Maine had to accept dairying. It was a good business; it has always been a good business. But to accept dairying they needed a better cow, and they took the Jerseys, and within the last 25 years the Jersey

blood, and the Ayrshire, Devon and Holstein have got mixed, and they have got mixed too much, but the Jersey blood predominates in Maine. You see we have had three periods. There have been three changes in the races of cattle in this country within its settlement. Now we have got to go on and do the best we can. We have these breeds of cattle,—some are breeding Jerseys, some Holsteins, and some Ayrshires. They are all good breeds and are all right in their proper places, but if we breed them we must start right. I am not going to say one word against what has been said here in breeding, but I want to emphasize one point. If you build a house you want to put it on a good foundation, or in time it will fall down. If you are going to build up a herd of cattle you want to start them on a good foundation. You want no guess work about it. It would not be safe for us to go to Wisconsin and buy a pair of Holsteins and try to raise up a herd and not find out whether they were sound or not before we started. Because possibly in the end we might find that they were wrong when we started and the enterprise would be a failure. To breed up a dairy herd, first start with a sound, solid foundation, and then go on with the instructions Brother Pember and Brother Gowell have given you.

Wednesday evening, December 5th, the Fifth Annual Banquet of the Maine Dairymen's Association was held in Drummond Hall. A large number of the dairymen and citizens of Farmington were present, and a very pleasant social evening was enjoyed.

The responses to toasts, by some of the prominent dairy workers and business men of Farmington were exceedingly brilliant and entertaining, and the music by Wheeler's orchestra, the solos by Miss Starbird of Farmington and the songs by the students of the University of Maine, were much enjoyed. The recitations given by Mr. Morse, the humorous reader of South Paris, also added much to the pleasure of the evening.

THURSDAY, DECEMBER 6.

A business meeting of the Maine Dairymen's Association was held Thursday morning at 8.30, opened by the president, F. S. Adams of Bowdoin. The report of the secretary was read and approved. The treasurer then presented the following report, which was accepted by the association:

Balance from last year's account............	$76 95	
Received from L. W. Dyer, secretary, for membership fees........................	56 00	
		$132 95
Paid bills as follows:		
J. Natt Gilman, bills for Banquet...........	$24 00	
L. W. Dyer, postage, stationery & telephone...	3 93	
Bill for badges.........................	14 85	42 78
Balance		$90 17

A committee on resolutions was appointed, as follows: Chas. D. Woods, E. F. Pember and W. G. Hunton.

The following officers were elected for the ensuing year: President, F. S. Adams, Bowdoinham; vice president, W. G. Hunton, Readfield; secretary, L. W. Dyer, Woodfords; treasurer, Rutillus Alden, Winthrop; trustee, W. K. Hamlin, South Waterford; corresponding secretaries, R. D. Leavitt, Auburn, T. B. Bradford, Golden Ridge, W. W. Harmon, Falmouth, C. E. Wheeler, Chesterville, J. A. Peters, Ellsworth, Otis Meader, Albion, O. Gardner, Rockland, A. C. Fossett, Bristol, J. A. Roberts, Norway, C. L. Jones, Corinna, F. W. Leland, East Sangerville, B. M. Patten, Topsham, H. B. Ellis, Embden, E. C. Dow, Monroe, A. E. Lincoln, Dennysville, F. B. Pike, Cornish; member of Advisory Council of Experiment Station, Rutillus Alden.

A motion was made by Mr. Pember that this Association ask Hon. A. W. Gilman, our Commissioner of Agriculture, to set aside the sum of $90 out of the $500 appropriation for this Conference, to be used as prizes to be awarded to students in the agricultural department of the University of Maine, for essays upon two dairy subjects, said subjects to be named by the executive committee of this Association; three prizes to be given on each subject, first, $20, second, $15 and third, $10; said essays to be read by the students before the Association at the Annual Dairy Conference. After considerable discussion, this motion was carried. It was voted that the president and secretary of the Association be appointed a committee to award the prizes.

The following resolution was presented by E. F. Pember, and on motion of Chas. D. Woods, it was adopted by the Association:

Resolved, That the State Dairymen's Association heartily endorses the action of the State Pomological Society in instructing its executive committee to petition the legislature to purchase

an experimental farm in the fruit belt of Maine, upon which the Maine Agricultural Experiment Station shall conduct investigations looking to the improvement of Maine orcharding, and hereby instructs its representatives on the Experiment Station Council to co-operate with this committee before the legislature.

Prof. Woods then briefly called attention to the invaluable services which have been rendered by the late Hon. H. C. Adams of Madison, Wisconsin, in the interests of dairying, not only in his own state but throughout the whole country; and stated that although he was a man of clean record so far as money matters were concerned, on account of ill health and other causes he had accumulated but little, and at his death it was found that his farm adjoining the University of Wisconsin had a mortgage of $3000 upon it, and that there was a note of $500 in the bank. He also stated that a movement had been made by the officials of the United States Department of Agriculture to clear this debt, and while there was no difficulty in procuring the money, it was desired to have from this Association an expression of appreciation for Mr. Adams' services. Prof. Woods therefore moved, that five dollars be taken from the treasury and added to this fund to be given to Mrs. Adams for the purpose of clearing the debt. It was voted that this be done.

The committee on resolutions presented the following, which were adopted by the Association:

Resolved, That this Association wishes to put itself on record in appreciation of the untiring, effective work of the late Hon. H. C. Adams of Wisconsin, in furthering the agricultural interests of this country, which culminated in the increased endowment of our experiment stations for researches in agriculture.

Resolved, That the Association hereby extends its thanks to the citizens of Farmington and especially to Mr. D. H. Knowlton, to whose efforts we are indebted for a cordial welcome and kindly treatment during this convention.

Resolved, That we are under renewed obligations to the railroads and press of the State for courtesies received in connection with this meeting.

CHAS. D. WOODS,
ELMER F. PEMBER,
W. G. HUNTON,
Committee on Resolutions.

SOME REQUISITES FOR PROFITABLE DAIRYING.

By Geo. A. Smith, Geneva, N. Y.

The subject of dairy farming which I am to present to you is one that has been threshed over so many times, discussed from so many viewpoints, that it would seem it must be entirely worn out. The only thing that keeps it before us is the realization of its importance by the thinking farmer who is striving to better his condition. Besides this, if we are to believe the conclusions which we see published, there are some people trying to make a living keeping cows who have not been converted to the modern methods of dairying, for which reason there is still missionary work to do in this line.

To make clear why this may easily be a fact, I wish to give a personal illustration. My early life was spent on a farm in Otsego Co., New York, where we kept sixty cows. Our method of doing business was the same as that of every other farmer in that section, for the farmers were all dairymen. The plan was to have the cows come fresh in the spring during March and April, to milk them through the summer and let them go dry in the fall. Everything fed these cows was produced on the farm. Not only that,—everything in the line of food and clothing for the family came from the farm. We lived upon what we ourselves produced and whatever money we obtained from the sale of butter and cheese was so much to the good.

If I had known enough (which I did not) to talk to my father or grandfather about the necessity of balancing the ration for those cows, or the individuality of the different animals requiring different treatment, I am afraid I should have received very scant attention, to say the least. I have given this to bring out the point as to why I believe farmers are often too slow in taking up and adopting new methods.

We grow up in the home and we become accustomed to a certain way of doing things which our parents acquired in the same way, and it is not easy for us to throw our early training to one side and take up an entirely new way of doing things. If methods of living and doing business were the same now as they were in those earlier days it would not be so important that we make a change, but we all realize now how different the conditions are.

Under the plan of living today the home necessities are largely supplied by others, who can make them in quantity with much less expenditure of time and energy than it would require for us to produce the same things. But we must buy these things and in order to do so we must sell the products of the farm in quantity and at a price sufficient to give us a surplus on the business. The price end of dairying has been very satisfactory the past year and still we hear some farmers complaining that the business does not pay. Whether this condition holds here in Maine I do not know. I hope not, but I do know it is true in many dairy sections. Good prices should mean profit to the producer; but if it costs more to make a product than it is worth on the market, the best of prices will only mean loss.

I do not know that I can point out the causes of this loss in some of our dairying in a way that will meet with your approval, but will do the best I can to make clear my idea of where the trouble lies. Looking at the business from the farmers' viewpoint it would seem that the main trouble is, he fails to realize the changed conditions of dairying although he does realize that it is constantly becoming more of a complex problem to make this business a paying proposition. Why is this so? I believe it is because the dairyman does not understand that his business is a manufacturing enterprise and must be run on the same careful business principles that apply to the manufacture of cotton cloth or anything of that character.

Take the case of the man who starts out in the manufacture of knit goods. First he determines what class of goods appears to be in greatest demand. Then he gets the latest machine, that will do that particular work most economically from the labor point of view. With this settled, he takes up the question of raw material, so that he may get that kind that will give him the most finished product with the least waste. He knows that if he does not do everything he can to keep the cost of production down he will not be able to compete with other people in the same line of business in the markets of the world. Do the dairymen study their business in the same careful way? Some of them do, I hope everyone here does, but I am sorry to say that there are quite a good many in the state of New York that do not realize the importance of knowing all about every detail of their business. If they want a mowing machine or any of that class of labor-saving machinery on the farm, they look very

carefully to get the best. They see the importance of that, but when it comes to that live machine that is to work over the raw material of the farm into a finished product in a way to make the business a financial success, they appear not to use the same business acumen. I can explain this in no other way unless it be that the inherited idea that has come down to them through generations of cow keepers that one cow is about as good as another and that the feed is the principal thing, still maintains with them.

Often when you ask a farmer about his dairy, he will tell you he guesses so and so. He does not "guess" with his crops, he knows when you come to that, but does not appreciate the difference in the ability of those cow machines to work over raw material into milk.

Now I am going to give you some figures to illustrate these points, which are not guesswork. First I will show you a chart that was worked out for our own dairy association two years ago. It brings out so clearly the point I am discussing that I think you will excuse me, although this chart has been used before, but not published. These figures were obtained from a creamery in one of the most densely populated cow sections of the state, a creamery running all the year.

Patrons number.	Number of cows.	Pounds of milk per cow.	Average value of milk per 100 pounds.	Cost of food per cow.	Returns from factory per cow.	Value of milk for $1.00 worth of feed.	Profit and loss.
No. 1	10	5,068	78.3	$26 00	$39 67	$1 52	$13 67
No. 2	15	5,784	80.5	36 00	46 58	1 30	10 58
No. 3	13	5,717	75.1	35 46	43 07	1 24	7 61
No. 4	15	3,783	75.5	24 00	28 60	1 19	4 60
No. 5	9	4,117	79.4	31 02	32 73	1 05	1 71
No. 6	19	3,094	70.	26 00	21 63	83	4 37
No. 7	9	2,872	71.6	26 00	20 56	79	5 44
No. 8	8	3,270	86.3	29 01	28 22	97	79
No. 9	20	2,174	72.4	29 00	16 18	55	14 82

This does not show all the patrons of that creamery but it gives enough to illustrate the difference in the business management of those farmers. In the first case the farmer sold the crops grown on his farm to his cows at a good margin of profit

over market value and from that grading down to the last man who sold his crop of hay, corn and oats to his cow at about half price besides doing all the work. It is hard to understand why this last man continued doing business in that way. The only explanation is that he did not know. His own figures when they were placed before him, he would not accept at first, but after going over everything he concluded they were correct and started at once to make a change. Today he is running the business on entirely different lines and is making it pay.

In order to bring out this point of individuality I am going to show you another chart. This is the record of three cows which we bought for our Station work. They were all of the same age and consumed practically the same amount of food. With these conditions they produced as follows:

	Milk.	Per cent fat.	Butter.	
No. 1	8,000 lbs.	5.6%	515 lbs. at 20c.	$103 00
No. 2	6,000 "	4. %	276 " "	55 20
No. 3	4,600 "	3.8%	251 " "	40 20

The cost of keep under our conditions with no pasture that year was $47.50. This shows a good profit for No. 1 and a small profit for No. 2. No. 3 lost what No. 2 made so that we kept three cows with all the labor connected with them to get a profit from one. This is a bad enough showing but it is not all. There was ten thousand pounds of milk produced, equivalent to four hundred and seventy-five pounds of butter, to go on the market. This helps make a surplus and tends to reduce the price. This reduction makes No. 1 less profitable. I think it is conceded that a surplus of dairy products reduces price, at least we have found it so in shipping milk to New York.

I will give just one more illustration of this point of individuality of cows. Last year we had two heifers come fresh at two years of age, both registered full bloods of about the same weight and consuming the same ration which cost $44.40 per year.

	Milk.	Per cent fat.	Butter.	
No. 1	5,586 lbs.	6.4%	411 lbs. at 25c.	$102 75
No. 2	3,848 "	5.4%	238 " "	59 50

I wish to emphasize the point, however, that having a registered animal does not necessarily mean a profitable one. Pedigree is a good thing if accompanied with individual merit, oth-

erwise it is of no value to the practical man trying to make a profit from keeping cows.

Two of the best cows in our barn are grade, one a grade Holstein producing last year 11,596 lbs. of milk, 3.8% fat, or 506 lbs. of butter, the other a grade Jersey producing 8,042 lbs. milk, 5.6% fat, or 517 lbs. of butter. Either one of these, any dairyman would be working on the right line to have in his dairy. So far, I have considered only the individuality of the animal but there is another phase of equal importance. You may have heard some one say that the feed makes the breed. While I must differ with that proposition, I am willing to allow that the feed is of very great importance.

Given the best cow it is possible to obtain, if you feed her improperly the production will be small; on the other hand, a poor cow fed the best ration possible will not make satisfactory returns.

It is difficult to understand just why two cows of apparently equally strong digestion differ so in their ability to work their food over into milk. On the other hand, I think I can make clear to you why the improperly fed cow does not make satisfactory production.

It has been said that "The inside of a cow is a very dark place, and it is hard to tell why certain things are so." This is true, but there are very many things that science has worked out to a definite basis in the nutrition of animals. It is known for a certainty that the starches, sugar and gum of a plant are utilized in the animal economy to produce heat and energy and that they can not be used to make blood or repair worn-out tissues. The substance that performs that duty is of an entirely different nature and is that part of the plant which we know as nitrogenous. In animal nutrition the first are known as carbohydrates or heat producers, the latter as protein or flesh formers. In order to keep an animal in normal condition, that is, without gain or loss, a certain amount of each of these elements is required in the daily ration.

This is one of the problems that science has worked out by conducting a great number of feeding experiments both in this country and in Europe, where all the conditions were controlled, thus enabling definite determination of what the animals required for maintenance.

The result of all of this work has established a standard. This requires for a 1,000 lbs. cow, not in milk, and kept comfortable, a daily ration of enough dry matter to supply seven-tenths of a pound of digestible protein and nine pounds digestible carbohydrates. A cow will maintain her normal weight upon this ration. If the cow is to make production, the digestible nutrients must be increased in proportion to the amount of milk she produces. Conceding these statements as to amount of food required to be true, the question with the feeder at once is, how can I combine a ration to best accomplish this result which at the same time shall be most economical?

Every farmer must work out to quite an extent for himself the business side of feeding, taking into account the things he grows on his farm and the markets. In order to do this he must know something about the composition of the hay and grain produced. A few years ago that was not an easy task, but now, owing to the free distribution of Experiment Station bulletins, every up-to-date farmer is reasonably well posted in all of these things.

I will give a few sample rations to illustrate this difference in composition and the necessity of knowing what the ration contains. The first is one that many farmers used in the past and then wondered why they did not get more milk from their cows.

		Dry Matter.	Protein.	Carbo-hydrates.
Corn Stover	20 lbs.	12 lbs.	0.34	6.88
Timothy Hay	10 lbs.	8.68 lbs.	0.28	4.86
Corn and cob meal	4 lbs.	3.40 lbs.	0.17	2.66
		24.08	.79	14.40

This ration has sufficient dry matter, and rather more than the required amount of heat and energy producing elements, but when we come to the protein we find only a fraction more than the required amount to build up the worn-out animal tissue. If the cow makes 30 lbs. of milk she must put into the solids of that milk, about one pound of casein, a nitrogenous substance, which she must supply from the protein of her ration. If you do not supply the protein she will take the lean meat from her own body to make normal milk which she is bound to do, growing poorer each day and in nature's effort to protect itself, shrinking rapidly in amount of milk.

Now we will take another ration which is produced from home grown foods the same as the other, but of quite a different composition:

		Dry Matter.	Protein.	Carbo-hydrates.
Corn stover	15 lbs.	9. lbs.	0.255	5.16
Clover hay	8 lbs.	6.80 lbs.	0.544	3.16
Mangels	15 lbs.	1.35 lbs.	0.165	0.84
Oats	4 lbs.	3.56 lbs.	0.368	2.72
Peas	4 lbs.	3.60 lbs.	0.672	2.13
		24.31	2.004	14.01

In this ration you see the dry matter and the energy producing elements are about the same as in the previous ration, but when it comes to the protein, in the place of only enough to maintain the body we have a balance to make production. We also have in this ration the mangels. You may say they do not contain very much dry matter, which is true, but just the same they are a good thing to feed. They add succulence to the ration which in this case means palatability, and every careful observer knows that insures better digestion and consequent better returns from the ration.

Another ration which differs from the previous one in that the succulency is obtained from corn silage instead of roots, which we believe is better economy, is made up as follows:

		Dry Matter.	Protein.	Carbo-hydrates.
Corn silage	40 lbs.	8.40	0.36	5.16
Alfalfa	7 lbs.	6.44	0.77	2.96
Oats	4 lbs.	3.56	0.368	2.72
Peas	4 lbs.	3.60	0.672	2.13
Cottonseed meal	1 lb.	0.92	0.372	0.44
		22.92	2.542	13.41

In this ration we have used alfalfa in the place of red clover because it is better in the proportion of protein which it contains and also because it will produce more tonnage to the acre when it can be grown. I have added a pound of boughten grain in cottonseed to build up the protein because it is usually the cheapest form in which protein can be purchased.

I will give one more ration in which all the grain is purchased:

		Dry Matter.	Protein.	Carbo-hydrates
Corn silage	40 lbs.	8.40	0.36	5.16
Alfalfa	7 lbs.	6.44	0.77	2.96
Wheat bran	4 lbs.	3.52	0.48	1.81
Distillers grains	3 lbs.	2.76	0.79	1.48
Hominy	1 lb.	0.89	0.07	0.70
		22.01	2.47	12.11

This is a good ration. The objection lies in the purchasing of all the grain. I believe every farmer can grow a part of the grain he uses to advantage, supplementing that with some of the rich protein foods like cottonseed meal. Not very many years ago the purchasing of the small amount of protein cattle foods used by the farmer was not a difficult task. There were only a few on the market and with hardly an exception they were reliable. Today we have a radical change. In the place of a few good ones, we have hundreds of proprietary cattle feeds grading all the way from oat hulls and ground corn-cob to straight linseed and cottonseed meal. This condition has been brought about by the manufacture of numerous things from the original grain and having by-products left. In many cases these by-products are valuable, as in the case of gluten feed, an offal from the manufacture of glucose from corn. On the other hand when oatmeal is manufactured for our breakfast, oat hulls are left and they certainly are not valuable as a grain food to supplement the coarse foods of the farm. I think with hardly an exception, the legislators of the different states have recognized these conditions and have passed laws regulating the sale of cattle foods and compelling the branding of the guaranteed protein on the sack in which these are sold. This is of great value to the farmer. He should make use of the information about the different brands, which he can get from the Experiment Station bulletins of all the prominent dairy states. I cannot speak as to the conditions here, but the trouble in the State of New York is that a good many farmers do not read the bulletins and have no especial knowledge along these lines. When they go to the feed store to purchase grain to supplement the home-grown fodder, about the first question is about price and too often they purchase the lower priced feed, knowing but little of its real value. Such a feed often has oats hitched on to the name in some way, and because the home-grown oats give good results, the buyer thinks that the mixture must be good. It would be good if it were oats; the trouble is that in most cases the feeds are largely oat hulls reinforced with some grain to give a little value but as a rule the farmer pays much more for actual digestible food than he would in the higher priced grain. When a farmer buys grain the one thing he should have in mind is, what can I purchase that, combined with my home-grown foods, will make a

palatable daily ration for my cows, carrying two to two and one-half pounds of protein, and be most economical? As a rule he will find that he will get more for his money in those foods carrying twenty-five per cent of protein and above. Another thing he will find is, that a combination of three or four grains will give better results than the same amount of digestible food in one or two. You may think the old cow is rather notional but you will find that it pays to conform your methods to her notions. You can get a good deal more in the way of concessions from a well-fed man than you can from a cross, dyspeptic one. The same thing applies to the old cow; make her comfortable, give her plenty of good food and if she has the ability she will pay you in the milk pail.

To sum up the whole matter, the man that succeeds in dairying at the present time, must know that his machine, the cow, is a good one; that she has the ability to take good raw material and give satisfactory returns for it, when it is given to her in sufficient quantities; that a good cow with poor and insufficient raw material cannot make satisfactory returns, and that a poor cow is not a paying investment under any method of treatment.

THE COW AND SOME OF HER IMPORTANT DISEASES.

By Dr. C. D. Smead, Logan, N. Y.

My effort this morning, for about twenty-five or thirty minutes, will not be to make veterinarians out of you, Brother Farmers, but to try to make what we call respectable cow doctors,—that is, in regard to some of the ailments that are affecting your herds to the greatest extent. The diseases that exist among bovine animals today, especially among cows, are those that are the most readily preventable, and I might almost say, readily curable, by the farmer himself, if he will devote a little attention to them. In the first place, I will call your attention to the cow herself. The best physicians are those that understand not only anatomy, physiology and therapeutics, but human nature as well. A physician may have all the knowledge necessary to make a successful practitioner and if he does not understand human nature he is a failure. And that is just the case with the whole

veterinary profession. There is many a farmer whom I know who is actually a better cow doctor than some veterinarians, simply because those veterinarians have not studied cows, and the farmer has studied cows and knows cow nature, and he, with a few simple drugs, is enabled to more successfully treat the diseases of the cow than the veterinarians who know only the science of the profession. At this Dairy Conference, the same as at all dairy conferences, the cow has been studied as an animal machine, as something that we have with us and can get a little more feed into, and draw out a little more milk and of a higher quality, and receive more money,—man's greed to be satisfied. I do not want to offer any criticism on what is being done. I simply want to call your attention to the fact that the drift, the tendency of the time, is to get high records from the cow, and what do we see, from the veterinarian's standpoint, as the result? The question is coming to me from the owners of herds of the highest records, and some of them right from Maine, What is the matter with the cow? There is trouble with the herds. Whence came this cow that we are talknig about today? Did God create her? No, God did not create her. The modern dairy cow, that is producing what Mr. Smith and other gentlemen here have shown, is largely a creature of man's imagination and his development. All that God created of the cow long ages ago was the beast, the same as other beasts. There was none of them that had a record of 3, 4, 6 or 8 thousand pounds of milk containing 4, 5, 6 and 7 per cent. butter fat. No, her early history as we have it, is simply that of a beast roaming about, giving just milk enough for her offspring. God did not create the cow to give milk for man. Man has simply taken her and developed her. It is of the utmost importance to you and the rising generation to study this condition. We find the cow roaming about upon the earth and producing milk sufficient to rear her calf, and reproduce her kind. How long did she give milk? Just as long as her baby needed it, about four months. That was the original cow, as history records her. Man domesticated her. He began to use her milk, and then, not being satisfied with the quantity of milk she gave, and not being satisfied with a four months' milking cow, he began, through a system of selection and feeding, to develop the cow, and we have kept breeding up and feeding up until we have developed a cow today with an udder of four,

five or six times the size and capacity of that of the old, original cow. We have succeeded in producing a cow that will not only give milk enough to rear one calf, but she will produce milk enough to well support two for four months, and then she will go on and produce milk enough for two more calves the next four months, and then enough for one calf for three or four months more. She does not stay on our farms long if she does not produce milk enough during the milking period to rear four calves to four months of age.

There are some other things that we have achieved at the same time. It is an immutable law of breeding that when we by breeding and selection abnormally develop any one organ in the body we do it at the expense of some other organ in correlation with it. When we have developed a large udder with the capacity of producing a large amount of milk, what have we done? What is the organ in correlation with it? The reproductive organ, and here is where we can call attention to the fact that a large per cent of the sterility today that exists after the cows have been in milk and have got up to five, six or seven years, is due to nothing else under the sun than the fact that those cows have been so bred and developed that their reproductive organs are weakened, they are dwarfed. That is the result in many cases. And right here we can account for a large per cent of the abortion that exists; it is no more nor less than inherent uterine weakness, together with sympathy. Please do not misunderstand me. I am not ignoring any germ, but I stand upon this platform and say, after careful study and observation and much work for the last 30 years, that 80 per cent of the abortion that exists in herds, from the Atlantic to the Pacific, can be traced to the weakening or dwarfing of the organs spoken of, together with sympathy which we do not understand. We have spoken of this cow all the while as a machine. She is a machine, an animated machine, but more than this, the cow has senses as we have. She has a sympathetic, nervous organization, the same even as man. That is a hard thing for us to understand. We must remember that the cow is subject to a shock through the senses, from smells and from sight, and the effects of them. We can easily illustrate this. Suppose there is a runaway out on the street, a man is thrown out of his wagon and trampled underfoot and brought right into this hall and laid

on this table, the blood flowing and perhaps some of the internal organs exposed. What will be the effect? We were not thrown out of the wagon, nothing has touched us, but I will guarantee that there will be men in this audience that will have to get right out of the door because of what the sense of sight conveys to them, the sympathy. If there is a bad odor here many people have to take out their handkerchiefs, and there will be a wrenching of the muscles of the stomach. I have been asked to say something in relation to this subject of abortion. When a cow from an injury, from uterine weakness or any other cause, aborts, if the farmer is negligent about it and leaves that little foetus right there, just remember that the other cows know it just as well as you know it. There is a sympathy that exists between them that has the same effect upon them as upon us. There are epidemics that prevail on farms from neglect, and are not caused by a germ at all. I have seen and investigated these cases until I feel warranted in saying that an epidemic of abortion will run through a whole herd and not be due to a germ, but to sympathy, by allowing a cow which has aborted and the foetus to remain in the herd. What is the lesson? An accident may occur, all the medicine in the world never would stop that. But the farmer himself can take that cow right away from the herd and treat her properly, with antiseptics, and the matter will come around all right. Eighty per cent of that serious trouble can be wiped out simply by a little effort on the part of the farmer himself.

Then, again, how are we going to avoid some of these troubles? I was very much pleased with what the gentleman here said in relation to oats. With some of our very best producing cows, instead of selecting cottonseed meal and some of the more concentrated foods, we shall have to be content with a little less milk, and feed those foods which will sustain the vitality of the cow. By feeding our oats and what we can raise on our own farms, and being content with perhaps 500 or 1,000 pounds less of milk in a year, we can keep that cow reproducing her kind as she ought to do.

Here is another little difficulty along the line of breeding. Every year more or less inquiry comes to us in regard to cows that are in a gargety condition. We call it garget, and yet there is a difference. I am treating cows that have been so bred, with

such a capacious udder, that it is almost impossible for those cows to even walk. When the udder is distended they cannot walk in comfort, and are bruising it continually. If a small boy and dog are sent after them, there will be an injury inflicted. We all know that a cow narrow across the huckle, with a dependent or swinging udder, is particularly subject to that trouble. With that shape of the udder, even lying down in a stall may injure it. If the udder goes over the edge of the drop, when the platform is a little short, or comes in contact with the cold earth or a hard substance, a little inflammation will be produced. That cow is a very abnormal beast, and that udder is a very abnormal udder. We can obviate this quite largely in our breeding, but when we have it, we have to do the best we can. If we do not get a gargety condition, there is a little blood in the milk that comes largely from the pressing from distention of the udder, through irregular milking. These are not really diseases. A little blood can get into the milk of the cow and really not be of any serious injury. But you should do the best you can to prevent this trouble. Again, there are cases with well formed udders where there is what we call a gargety condition. The cow will perhaps be giving a little thick, lumpy milk. There may be a little temporary inflammation in the udder. The udder is sometimes tuberculous, but not all cases of hardening of the udder are caused by tuberculosis, only a very small per cent. It comes from injury; a little abscess caused by a little inflammation, and for the time being the secretion of milk is not as it should be and there is a little blocking up, and from that cause a little bit of purulent discharge. As a remedy for this, teaspoonful doses of the fluid extract of pokeroot given two or three times a day, and the application of hot water will usually be effective. There is something invented better than that. If we could get at the real seat of the injury and wash it out inside as we could wash it outside, we should accomplish more than we are doing. There are men who are studying on this, and it is with pleasure that I will show to you, after we are through with the meeting, a very simple device that every farmer should have. It is what we call an udder syringe. With that we can wash out the udder of the cow and get rid of these purulent formations that come from bruising or other causes. This was sent to me

to test, and I have given it a thorough test. You, as farmers, know this fact,—that when a cow out of one quarter begins to give a little of that stringy, cheesey milk that is not fit to save, you are pretty well satisfied that about four times out of five that cow will have the garget or lose that teat. So I am glad to show you this simple devise to wash out the udder of the cow. I feel very safe in saying that in at least five cases out of six where the quarter of the udder would otherwise be lost, it can be saved if the farmer himself will use this instrument. He must be his own veterinarian. It would not be policy for him to go to a veterinarian, as if the veterinarian had to come and wash out the udder twice or thrice a day, as the case might be, it would be rather an expensive job for the man who owned the cow.

Here is another trouble. Until very recently one of the most serious troubles that we found, with the first class cows, was milk fever,—parturient apoplexy. Many of the farmers mistake it for udder garget. Udder garget is an inflammation of the udder. The other is an incipient trouble which will lead to inflammation of the udder before we are through with it. Before the discovery of the air treatment it took a good veterinarian to treat this disease, and he was a good veterinarian, if he was called right in the commencement, who could save one cow out of five. But this device, simply pumping sterilized air into the udder, will enable the farmer to save a large per cent of the cases.

Previous to this a preparatory treatment, the giving of salts, was recommended from the platform, and I have given it through the press; and I do not want to take it back. I say that if a farmer, about two weeks previous to the expectant birth of the calf, will give the cow a little less ration, if she is an exceedingly large milking cow give her about half a ration, and a simple dose of Epsom salts, ¾ of a pound for a Jersey and a pound for a Holstein, adding to that as a stimulant a little gentian, and will repeat that every week, the chances are that the cow will not have the trouble. But the farmers do not always know when the cow is coming in, and so I will say that today this is not as necessary as it once was. When the discovery was made that air injected into the udder would reduce the inflammation, it was a great boon to the dairymen. I might say, however, that iodide of potash, and even warm water, will work quite well, but the

air will permeate the udder and work back. You would think that this was an impossibility, but when I have pumped up the udder as full as I could pump it, and then in a few minutes it would be flaccid, I know that I have pumped the air there and it must have worked back. The farmer who keeps even five cows should have on hand an air syringe, this milk fever device, that is now prepared and put upon the market at a nominal price. A veterinarian cannot be prepared at all times to protect you. A veterinarian may be living in this village and you may live a mile out. He may be one of the best in the whole land, but if you go after him he may be away from home, and perhaps he cannot get to you until it is too late. So it is necessary that a man be prepared himself to treat these common diseases. This little device every farmer should have, and then he is prepared to treat that case of milk fever or that case of garget. He is then a cow doctor sufficiently to combat successfully at least 90 per cent of those cases, if he uses this just as soon as he finds out the trouble.

There is another trouble,—I do not know whether it prevails in Maine but I know that it prevails in New York. You have seen some of it on the Experiment Station farm, where the sanitary conditions were good. For lack of a better name we will call it a germ garget. It was first believed to be cowpox, and some veterinarians so consider it now, but from what I know of cowpox I cannot agree with them. It begins with little blisters on the side of the teat, which will be very sore. The little blister will break and then there will be a little scab. When I first discovered this in the State of New York I thought it was cowpox and said, the animal will get well. But, lo and behold! she did not. That tiny blister broke, then a little scab came over it and instead of that healing, another little ring of blisters would come around the outside of the scab and then a little matter would form, and it would continue to spread and spread until one blister not larger than the head of a pin I have known to develop into a spreading ulcer that I could not cover with my hand, and run over the whole udder and destroy it. Something ought to be used in the nature of a germicide. There are several things that will destroy it. I have found nothing better than carbolic acid. Make a two per cent solution, one part of carbolic acid to 50 of water, and keep it right on hand, and then use some car-

bolized oil in case it is on the outside. The carbolized oil is no more nor less than a certain per cent of carbolic acid mixed with oil. I select the pure, raw linseed oil, because I am more sure of getting it pure, then take one part of carbolic acid to ten parts of this oil, and it makes one of the finest applications to put on to the sores, and is a germicide as well. I prescribe this in the most favorable form, but there is a worse form. That little germ that caused the blister on the teat may not start there, and, in fact, it does not start there as often as it does in some other parts. It comes unnoticed. It starts right at the end of the milk channel, right at the end of the teat, and is so small that the farmer will not notice it until it gets the start of him. There is where the danger comes in. The first noticeable thing would be that when you start to milk the cow would be nervous and upset the pail, and then you might have a stable scene. You would not understand why the cow kicked. The fact was, there was a little blister at the end of the teat so very tender that the minute you attempted to start the milk out of the udder it gave her excruciating pain and the cow resented it. The man did not notice it; he did not know where to look for it. The next time it might be the same thing, and usually about the second or third, sometimes the first and rarely beyond the third, the man would notice that the teat was hot and tense. I do not know the nature of the germ, but I know that it must be a germ because I see the effects. The nature of it is worthy of experimentation by our bacteriologists. We have reason to believe it comes from the stable. But why does it get at the end of the teat? Simply because there is always moisture, there is always warmth there. If the cow lay down and the end of that teat came in contact with the germ, it could take its root at the very end where there was warmth and moisture, and then the tendency is to spread up the milk duct or the milk channel and the whole milk channel in time will become inflamed. That is what made the teat tense and inflamed. It will work right up and destroy the udder. It will go right up into the quarter of the udder and ramify through it, and at last it becomes sometimes an abscess, and sometimes it stops there and destroys that part of the udder. That can be headed off, on the line of which I have spoken, if the man will take it in time, but he must not loiter. When a man sits down to milk a cow and the cow kicks the pail over, he should put on his spectacles and

look at the end of the teat, and he will find a blister. And then if he will give it attention then and there, he will head off the trouble. Sponge it off with a 2 per cent carbolic acid solution and as he does not know but it has already worked up into the teat, he must stop it there or it will destroy it. Every farmer should have at least a little ten cent glass teat syringe. A man can have the carbolized oil and this little syringe, and then after he is through milking, for fear that little germ may have already started up the milk channel, he should inject about a teaspoonful of the oil right up the teat and milk it out again. This greases over the milk channel and the germ cannot climb up. Of course you want a syringe with a small nozzle. It is not necessary to have a long pipe to it; half an inch is plenty long enough, and you want to use only a little of the oil.

There is another feature of this trouble, it will go through a herd. It is contagious, it is infectious, and it is carried many times, unconsciously, by the milker himself. He milks a cow that has this disease, then sits down and milks another cow, and the result is that he has carried the germ on his own hands, the very best way it can be carried. Realize it is the unseen things that are the dangerous things in this world. We cannot see the germ, but we must realize and believe that it is there just the same. After we have handled a cow that is diseased with this germ garget, we should thoroughly wash our hands and dry them before milking another cow. Let us go a little bit further. You realize that an infectious germ is there. You cannot see it but you know the fact. One cow has it and you do not know but the others have. Let us be safe. There is no harm in using, with all of the cows, a little carbolized oil on the teat once a day. I have known a man to lose 22 cows out of a herd of 30, simply by carrying the disease. If he had simply known the nature of the disease and the remedy I have suggested, he could have been his own cow doctor and prevented its spread. But do not neglect the very first teat that shows the trouble. Make it the business of the day to go to the drug store and get the carbolic acid and the oil and the syringe. One to ten is the strength in using it; inject it up into the teat and milk it out. You may not save the case if the teat has become hot and tense and it is almost impossible to get the milk out of it. I never knew of a case being cured after the udder became tense and hard. Another important thing,—

there is a case where the teat gets into that condition, it is impossible to milk that cow, and yet you discover nothing wrong with the udder. There is where the milk tube comes in. This is one of the most valuable instruments for a dairyman, and every dairyman should have it. He should know what a proper size milk tube is, and he should know how to use it. Here is where the difficulty comes. A man will say, I tried to use a milk tube and I spoiled the teat. A man here has some milk tubes for sale, and if I should simply say to you that you should buy a milk tube, and you went to buy one, I guarantee that you would pick out the longest and the largest, because they are all of one price and you are all Yankees and want to get the most you can for the money. I am not going to discredit the sale of those milk tubes, but half of those on exhibition here are not adapted to use with the cows you have here. If a man bought one of the longest and largest ones here and took it home, what would be the effect? It seems as though men think that the further they insert the milk tube into the udder, the more milk they are going to get. That is not true. All the milk there is in a cow's udder is right beneath the real body of the udder, and the tube should never be inserted farther than simply up into the milk cistern, not up too near the udder, because you are using a hard substance in a very sensitive gland. A tube 2¾ inches long is really too long. There is not a cow on your farm or in your herd but that a 2½ inch tube will reach the milk cistern. So much for the tube. Now how are we going to use it? I do not know how many germs there are on my hands, nor anybody else. I washed them this morning, but I do not know anything about it. If I were to simply come down from this platform and insert that tube into the teat of a cow, the chances are that some germs would be carried up and they might be germs which would irritate or inflame. Here is where the carbolized oil becomes a handy thing to have in a stable. If I had that mixed right here I would dip the milk tube into it, and in about one moment it would be safe and really disinfected. If I did not have that, boiling water is one of the finest disinfectants. I would simply dip my milk tube into that. No milk tube should be placed up the udder until it has been disinfected, and the man must not touch it with his hands after that has been done. That is along the line of what I was telling you in relation to the milk fever device. A man will say, Yes, I cured

the cow of milk fever but she had the garget right away. That was because he did not disinfect the device. Use hot water if you have not carbolized oil. Some advise bi-chloride of mercury. I have no objection to that, but the farmer does not always have that on hand and it is not a safe thing to have around; consequently I will say it is not necessary to have it. Let the veterinary profession use these active poisons. Carbolic acid the man can learn the nature of, and he can keep it away from the family and learn not to take it himself. We advise that in preference to the other, to put into non-professional hands. There are other things which can be used, but carbolic acid is the simplest and so we advise it. I do not always use it myself.

Ques. What do you think of carbolic acid as a preventive for abortion?

Ans. I think everything of it where I have reason to believe that germ abortion exists. My experience differs somewhat from that of some of our scientific men. It has been claimed that it is an utter impossibility to give any drug through the mouth that will enter the blood, of sufficient virulence to destroy a germ. That has been asserted, and I think it is today the popular belief among scientific men. And yet for the past four or five years, more than at any other time, I have been recommending giving to a cow, where there was reason to believe there were infected germs in her body which would cause abortion at 5, 6 or 8 months, as the case might be, 25 drops of the carbolic acid prepared by a druggist, at about the third month. The druggist will liquefy it by mixing with water or glycerine. Give this dose daily by first putting it in a half pint of water and using the water to wet a feed of bran with, for two or three weeks, sometimes as long as a month, then skip a week or two. In that way I am well satisfied that we have aided in the eradication of this trouble. Of course this was supplemented by cleanliness and disinfectants.

I am well convinced, although I could not prove it, that when we get right down to practice, we can give carbolic acid and perhaps other things, in sufficient strength to prevent the multiplying of the germs if it will not kill them. Hence I say carbolic acid can be given safely if it is given properly.

Ques. Would it be all right to put an ounce of the crystals in a quart bottle of water and give the cows a big teaspoonful?

Ans. I would not want to say that that would poison the cow, but it is stronger than I would want to give. We want to be safe, and I would rather give it as I have suggested. I do not want to go beyond my depth. I know by experience that 25 drops highly diluted with water is safe. I would advise the farmer to mix 25 drops of carbolic acid in half a pint or more of water, and mix a feed of bran with this and let the cow eat it. This is a very easy and feasible way, and thus far with me has proven very effective. If the farmer attempts to drench the cow every day, he soon gets tired of it. I will guarantee that the third day ends the drenching. Of course there are other things, as some of the coal tar products, which can be used as antiseptics, and for washing out the vagina, etc.

Ques. In case a man had a lot of heifers away from home, at pasture, could he mix carbolic acid with the salt and salt them regularly?

Ans. I do not want to recommend as virulent a remedy as carbolic acid mixed with salt. It is very easily given in a bran mash or a similar way. It should be continued for a period of about two or three weeks, then skip two or three weeks and then begin again.

THE RELATION OF THE DAIRYMAN TO THE CREAMERY MAN.

By J. NATT GILMAN, Pittsfield.

My subject is rather an important one, to both the creamery man and the dairyman. Some of the creamery men consider the farmers the important end of our business, and surely if there were no dairymen there would be no creameries. On the other hand, we consider the creameries an important factor to the dairymen. If you go back a period of years, perhaps 20, and compare the facilities of doing business along dairy lines at that time with those of the present, it will show a great development. Consider the pan system of raising cream, of 15 or 20 years ago, as compared with the separator system of the present time; also compare the system of manufacturing butter on the dairy farm and marketing it in small quantities with the manufacture of butter at the present time, and you will see the vast improvement and the great development. I have been in the creamery business but a few years, a little less than five years, and oftentimes the farmers have circulated reports that I was a robber and a thief by being in the creamery business. I would dislike to be called those names, and would investigate the report, going straight to headquarters, and would find that there was some dissatisfaction on the part of a dairyman in regard to the handling of his product. And by going right to the foundation head and asking for facts in relation to those reports, we would very often overcome and correct difficulties that if they were not promptly attended to would create a great deal of dissatisfaction among the farmers in the whole neighborhood; and that dissatisfaction might really be caused by a mistake in bookkeeping. I think there is one word that will relieve a great deal of the distrust between the dairymen and creamery men, and that is, *investigation.* I suppose most of you farmers are patronizing creameries, selling them your sweet cream or sour cream, as it may be. When you have a fault or a complaint to make, is it not well enough before you talk considerably among your neighbors, to investigate the matter thoroughly and see whether you are at fault, whether the creamery man is at fault, whether your cream collector is at fault, or whether a mistake has been made in the process of doing

business. Do not condemn the creamery man simply because a mistake has been made. Farmers are just as liable to make mistakes as creamery men. On the other hand, creamery men are just as liable to make mistakes as farmers, because we have a great many figures to make and carry out in the course of a month's business. There is one thing that is of vital importance in the carrying out of a correct system in any business, and that is to be careful to protect the interests of all concerned. Before we started in business we tried to put two and two together to make four, in a complete system of carrying on our business. Before going into the creamery business I was on the road and had an opportunity to call on the majority of the creameries in New England, and had a pretty good opportunity to investigate the different systems that were being used at those creameries; and when I went into business at Pittsfield in a small way, with one plant and a small number of patrons, we introduced a system there and have carried it out as far as we could, making changes and improvements from time to time, and I think we have as satisfied a lot of patrons at our creamery today as there are at almost any creamery. We have had our troubles, the same as others, but we are always willing to give time and attention to all complaints entered. No matter how far distant the patron is, we try to go to him personally if we can, and if not, we take up the matter by correspondence. But farmers dislike to write letters. They have a complaint to make, and instead of taking it up with headquarters they will do so through their cream collectors. The cream collector is not a natural correspondent, and the matter goes unattended to for two or three weeks, until it gets around to headquarters. In that time the farmer has become disgruntled and dissatisfied and condemns the whole system from start to finish, which is a mistake.

I think the introduction of hand separators and new systems of manufacturing butter, and the development of the markets, make the creamery question more complicated. Originally cream was bought by the space, and a space of cream was supposed to make so much butterfat. Of course the quality of the cream varied, and consequently the results obtained varied, and if one farmer thought he had just as good cows as another, and one of those neighbors got a better return than the other in a month's payment, there was cause for controversy. They

began to discuss the subject, and it spread, and the report came back to the creamery that something was wrong with the creamery systems. In our work, and I suppose all other creameries are the same, we try to carry out systems that are accurate. We have a state law that compels us to have help that is properly informed in regard to the operating of the Babcock testers, and in order to have accurate work done this law goes still further and compels us to have bottles that are tested at the Experimental Station and acid of a certain strength. We have a Dairy Instructor, and although he has not very much authority I think the creamery men are all glad at all times to have him call on them and investigate their systems of doing business, and see that their apparatus is according to law. We are glad to have Mr. Thompson call on us and look after these things which go to make satisfactory results in the carrying out of the creamery business.

In our system of buying cream, the cream all comes to the creamery in individual cans and is sampled at the creamery. I will not say that the farmers get any better returns than they would under other systems, but we, as creamery men, can know the condition of the cream as it comes from the farmer. We know practically all the conditions of that cream from the time it leaves the farmer's hands until it reaches the market. Three or four years ago we introduced a system of discounting sour cream, and in order to carry that out thoroughly it was necessary to have the cream come in individual cans, and this is one of the strong points in our system. Every farmer owns his own cans, and nobody else uses them. He knows the accurate weight of these cans, and the cream can be weighed both at the farm and at the factory, if necessary. The cream is collected in them either by having a double set, or pouring from storage cans into these cans. We have been asked if the cream will not churn, if the can is not full. I have had considerable experience in collecting cream in individual cans in small quantities. We have two sizes of cans, only, and have collected cream from a distance of 20 miles in five-gallon cans one-third full, and the cream reached the factory in good condition. We recommend to the farmers that they produce cream that will not test over 25 per cent, and I think 99 out of 100 produce that grade. This will not easily churn. If a farmer is producing cream that tests over

that he is taking chances of having it sampled properly. Every lot of cream is sampled immediately after reaching the factory. Then the sample is put into a bottle and preserved with bichromate of potash until the first of the month, when the tests are made. We pay toward the last of the month and we keep those samples until after the patrons have received their returns, and then if there is any dissatisfaction we are willing that they should have the sample and send it to Orono and have it tested. Also our collectors are all instructed to take samples for the farmers when desired. Then the farmer can send the sample to the Experiment Station if he has not a tester of his own. We are careful to carry out our process of testing according to improved methods advised by the United States government and by our Dairy Instructor, and by law, and, as I have said, there seems to be but little dissatisfaction among the patrons.

VARIATIONS OF TESTS.

By W. G. Hunton, Readfield.

Those of you who were present at the Dairy Conference at Pittsfield last year will remember that we had there a most able discussion of this same subject by Prof. Hills of Vermont, from the theoretical, scientific standpoint. I am not a disgruntled patron of any factory. I have been producing cream for factories for over twenty years and never had any trouble but once, and we fixed that up in 15 minutes. But I know there is a feeling of unrest between creameries and patrons, whereas there ought to be the utmost confidence and mutual respect. They are so far dependent on each other, that one cannot afford to lose the other. I went home determined to find out, as far as I could, with a herd of cows which I thoroughly understood, if the statement made by Prof. Hills was in any degree true in my particular instance. He said that 90 per cent of the causes of dissatisfaction were with the farmer rather than the creamery man. With my cows I have no period during the year when they are all, or a large per cent of them, strippers. For a number of years I have been endeavoring to get up the same flow of milk during the year, and I have about an average of two fresh each month. I have 25 cows, and raise my own calves. I took my Babcock

tester and I began to follow out Prof. Hills' instructions to the letter. Those of you who have read his talk or have heard him, will remember that he said the first cause of variation in the test would be a variation in the conditions of the cow,—the temperament, the way she was handled. I handle my cows myself, and it took me only a month to convince myself that although by a sudden fright, or something of that sort, I could make one cow vary very much in her test, taking a composite sample it could only be reckoned in tenths. Another point the professor made was in the separator getting out of order. I use a separator. I unbalanced my bowl, to try that, and there I found that I got large results, as I think. I got about 2.1 variation by a wabbly bowl. I got as high as 2.7 variation by a change of speed from 42 to 52 revolutions. Those experiments were made in the winter season. I did not get around to an important thing which was brought out by a conference with our Dairy Commissioner late this fall, but I had an opportunity two weeks ago to satisfy myself that one of the principal troubles with me in the past has been in the time of separating my milk. During the cold spell we had last week I tried milking 25 cows and letting the milk stand until they were all milked, then separating it; and then the next day I separated it as fast as the boy milked, and there was a variation of 3 per cent in the test of that cream in the two mornings. Both of them were cold mornings, so that particles of ice formed in the lean-to. Now to go back to the point which I wish to make and emphasize, and which I really hoped this Association would take some measures on before it adjourned. What interested me the most was the manner in which the creamery man took the sample from which to test my cream. The man who drives on my road has to drive in the neighborhood of 20 miles, collecting cream. He arrives at my house, in the summer season, at about 10 o'clock and then has to drive 3½ miles to make his train. In the winter season I think the train arrangement gives him an hour longer, but he does not get up quite so early, so is about the same length of time on the road. I began asking him to save me a sample when he took the sample for the factory. I found when I tested my sample and got my test from the factory there was a variation. I do not think it ever exceeded one per cent, but it was not business. I then began taking a sample myself, and then letting him take a

sample, and I found there was just as much variation between the sample I took myself and the one which he took. Invariably my sample was the lowest. The sample that he would leave me would test higher than the sample I took myself. I could readily see that I took more pains in taking the sample. In taking those samples in cold weather, half the time the instrument would not be in proper condition to take the sample. It would be cold, the top of the cream would be a great deal thicker than the other, and in plunging it in, it would be clogged in the top. The result would be, in using force to drive the sampler down to get the cream the hard particles were driven up, and he got consequently a thicker cream than the whole would rightly sample. I believe that the creamery men must meet the farmers half way and have our cream sent to them in individual cans, and have our cream sampled as carefully as we could sample it ourselves. I believe it is possible and right.

Furthermore, if I am taking pains with my stable to produce a cream that is freer from barn odors than that of my neighbor, and my cream is mixed with his, the creamery man is unable to tell who is producing the best article. I do not for a moment believe that the creamery men want to be dishonest, but I do want to say to them that they are doing one thing in my section that is going to breed trouble. When a man's test runs down 2 or 3 per cent, he complains. They go and look it over. He says the cows have not changed much, I have turned the separator myself and the screw has not been changed. And then the creamery man will say, perhaps you have not got all that belongs to you. And the man will say he thinks he ought to have $25, and they will leave it to three men. I do not feel right about this. I do not feel that the creamery man has absolute confidence in what he is doing. I believe my creamery man is honest, and that my neighbor is honest. If the trouble does not come between those two men, where is it? Therefore, I say the only true way, or at least one step in the right direction, is to have all our cream come to the factory in individual cans, so that we will get one step nearer the creamery man. If my cream is taken from where I keep it in a reasonable time to the factory I will take my chances for the sample.

COW TEST ASSOCIATIONS.

By S. C. Thompson, State Dairy Instructor.

I shall take but little of your time in this paper on "Cow Test Associations," but I hope that I may mention some point which will appeal to you as dairymen and creamery men and thereby cause a discussion of this important subject, which shall bear fruit and be the starting point of more systematic and careful selection of dairy animals.

"Cow Test Associations" are comparatively new in this country, although enough has been accomplished to attest their great worth. In Denmark where they originated, they have become very popular and are accomplishing such results, that even the most skeptical must admit their great value. Institute workers and dairy lecturers all over our country have urged the necessity of a carefully selected herd for profit, but notwithstanding this, there are comparatively few individuals who know exactly what each cow is doing in the way of production, and while almost every one realizes the importance, they neglect it because of the amount of bother, which seems large, together with an element of uncertainty as to the amount of knowledge required for success, also a doubt as to their own ability to interpret results.

The object of the Test Association is to interest collectively, where individuals seem to falter, and accomplish through some agent a result not otherwise obtained. The plan adopted in Michigan is to form an association of about thirty members who sign an agreement for their mutual benefit; to provide means for co-operation of the members for testing each individual cow at stated periods for one year and thus determine their production in pounds of milk and butter fat. They agree to pay a certain sum, usually one dollar per cow per year, to defray the expense of taking samples and making tests; and to board the person thus employed and take him to the next member. With thirty members, one man could be employed who would visit each member once every month and weigh and test two milkings.

The records which should be preserved for reference, should be kept on uniform blanks which the Department of Agriculture would be glad to furnish for the benefit of having the results on file in their office. The other expense to the members would be

small, in fact almost nothing, and at the end of the year, each of the thirty members would know the amount of milk and butter that each cow had produced, with an outlay of but one dollar per cow.

In Denmark, where the idea originated in 1895, it has grown from two associations with forty-seven members and 834 cows, to over one thousand associations with over twenty-two thousand members and over 300,000 cows in 1906, or almost one-half the entire number of dairymen and cows in the Kingdom. The average herds in ten associations for five years have increased the milk production from 16 to 1506 pounds per cow and the butter production from 13 to 63 pounds per cow.

These results were obtained in a country where the average production per cow was very nearly double that in the State of Maine at the beginning. What, then, could be accomplished here?

A committee of the Vermont Dairymen's Association says in relation to the history and growth of the movement, as follows:

"In 1895 members of a local cattle breeders' association in Vejen, Denmark, organized for the purpose of learning, and possibly increasing, the productiveness of their dairy herds, comprising some three hundred cows. They found the milk and butter yields rather light as compared with the cost of feeds, and that the margin of profit was not satisfactory. The farmers realized that, in order to increase the productiveness of their herds, they must ascertain the yield of the individual animals. This might be costly, and in some cases even impracticable, for the farmer to carry on single-handed, but on the co-operative plan the cost to the individual would be slight. So they set to work to use scales and fat tests at regular intervals, and carefully to keep records of all details connected with the work. The movement was watched with interest and a number of new associations of a similar nature were formed each succeeding year.

The by-laws adopted by the first association have been largely copied. They cover a statement of the objects of the association and provisions as to membership and withdrawal, assessment of expense and collection, choice of board of management, and as to meetings, voting, etc. The rule relating to the operations of the person in whose charge the work is placed is of especial interest. It reads:

"The board of management shall, on behalf of the association, engage an expert assistant to attend to the sampling and testing of the milk from the individual cows owned by members of the association. The assistant shall also keep a correct and complete account of the milk and butter yield from, and the quantity of food consumed by each cow. He shall also prepare statements showing the comparative results from the different herds and individual animals of each, in order that a selection may be made of the animals which would appear to be specially valuable for breeding purposes."

"The association pays the assistant a stated sum per year. He is furnished room and board during his periodical visits, and is conveyed with his equipment to the next farm on his route. When the year draws to its close he prepares a report and a statement showing the results of the year's work. These are laid before the annual general meeting of the association and printed for distribution among the members. These reports contain interesting facts, and give rise to considerable discussion and reflection. They show at a glance the financial standing of each cow in each herd, indicate the yields of milk and butter, and the quantity and cost of feed consumed. One of the early reports of this pioneer association shows that one cow of a certain herd produced 10,183 pounds milk containing 382 pounds of butter, at a cost of $63, whilst another in the same herd gave 4098 pounds of milk, yielding 133 pounds of butter, at a total cost of $50. The duties required of the assistants in Danish associations demand that they possess a general knowledge of farming operations, and skill in the work which they are engaged to do, viz., milk sampling and testing, and, also, the accurate handling of the simple mathematics of addition, multiplication and division. Ability to give general advice to the members of the association as to their part of the common work is also a desideratum."

There seems to be a good field in the State of Maine for this work and many localities are so nicely situated, that the work could be conveniently done. Our creameries could be of great assistance in this work and should be vitally interested, because an increase in production would bring more profit and greater satisfaction to their patrons, together with an added interest in their whole dairy work, and insure greater care in handling and consequently better quality of product.

The creameries with but little increased expense, which the patron would gladly pay, could send a man who could properly take samples at frequent intervals and bring the same to the factory for testing, thus losing but little time in the factory, and at the same time he would be fitted for the class of work which he is called upon to do.

The Department of Agriculture will be glad to give all the assistance in its power to this cause, for without doubt, this is one of the quickest and surest means of aiding our dairy interests and we believe that time spent in this line of work will pay a large return in future years. This Dairymen's Association should also help by being recorded in favor of such a movement, if it believes in its wisdom, and take such further action as may seem necessary and wise, for the succesful operation of this idea. Prof. Smith of Michigan, which was the first of the states to undertake this work, says, "It has scored a wonderful success but not without its discouragements." This seems the easiest way to accomplish a desired result and all that remains to be done is for the interested ones in any locality, both the dairyman and the creamery man, if there be one, to set about to increase the production and profits by this system of co-operation, as set forth in the test associations.

A. W. Gilbert—I will say that if there are any dairymen who want to take up a proposition of this kind, there are plenty of men who are taking up the short course in agriculture at the University of Maine who are especially fitted for this kind of work; who have the ability to test milk by the Babcock test, and work out the value of feeding stuffs and all this sort of thing. If there are dairymen who wish to take up this matter I think we can supply the boys. It seems to me that those students are especially fitted for this work.

A. W. Gilman—This plan strikes me very favorably. It is of but very little use for us to try to educate the average farmer up to the position that my Brother Ellis now holds. We have advocated that the farmer should know what each individual cow is doing, but you know the men on the farm are very busy, and they have never done this, as a rule, and I do not think you can convince them, by lecturing and talking, of the great benefit that may be derived from such an association as this. While we were holding institutes the past few weeks, it was our pleasure to

have with us Director C. D. Smith, from the Agricultural Experiment Station, Mich. This was his first experience in the State. He hardly ever addressed an audience but that he called their attention to what they were doing in Michigan in this line. The farmers were rather loth to take hold of it and thought it would not amount to anything, but in a short time A got to talking with B about his tests, and just as soon as they began to know what each individual cow was doing and the amount of feed it took to accomplish the result, every man began to study into the conditions, and to see how he could better them, and cheapen the product. In some sections I do not know but the herds that are of special value are too far apart. I suppose in other parts of the State, where the herds are not such a long distance apart, such an association could be formed. If 30 herds could be found within reasonable distance, so that each herd could be tested and the product weighed once a month, then you will have the whole thing officially. I have no doubt that this would be the right step to take, and the farmers of the State of Maine would receive much benefit from such an association.

Mr. GILBERT—I believe if one association could be started it would open the way for others. It is just a question of starting. I would suggest that Mr. Thompson investigate this matter pretty carefully and work out a constitution, if it is necessary to work out the details for a certain section, and see if he cannot get one association started in this State. If we can get one started I will guarantee that a good many more will be started. If we can by the expenditure of $1 per year save ourselves $5, anybody can see that it is a grand financial investment.

On motion of Mr. Gilbert it was then voted that in case any dairymen wanted to form such an association, Mr. Thompson, the State Dairy Instructor, be a committee to look after the matter and arrange the details.

HOW CAN THE CREAMERY PATRON IMPROVE HIS PRODUCT?

By W. K. Hamlin, South Waterford.

I do not feel competent to speak upon this subject, but I will undertake to do so very briefly, first, because I realize that our worthy Secretary has very much to contend with in arranging for and working up this meeting, and I desire to go on record as being willing to do what I can to aid him in his efforts; and second, because it is said to be better to try and fail than never to try at all. Last of all, the subject, "How can the creamery patron improve his product?" seems to be so easy of solution that any one might answer it without much difficulty. In this connection the products of the creamery patron will be treated as meaning milk or cream, and every creamery in the State is deeply concerned in the problem of how to make them better, and has made rules and given instructions to its patrons until it would seem that nothing further in this direction should be necessary. Still, the creameries are receiving cream of an inferior quality. What is the reason for this state of affairs? It would certainly seem that if poor cream is still produced it must be because the patron lacks interest in his business and is not doing as well as he knows how to do. What is the greatest difficulty in the way of getting cream of the best quality at our creameries? Is it want of good cows, comfortable stables or suitable appliances for doing the work and caring for the cream? Not necessarily. Can it be due to lack of knowledge on the part of the patrons of how to feed their cows in order to get the best results; a knowledge of the necessity of thorough ventilation and of keeping everything about the stables and dairy clean and sweet? To the person of an inquiring mind these problems are not so very difficult of solution. Countless bulletins on just such subjects are constantly being published by our experiment stations and may be had for the asking. We have also our State Dairy Instructor, our State Dairy Conference, our farmers' institutes and the dairy journals, all of which are valuable sources of information in all these lines. What, then, do we lack, in order to attain the desired condition? We feel sure that we have found the great source of nearly all causes for inferior milk and cream

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Wilkes Stallion, Phillip, 2.25¼. Owned by R. W. Maguire, Foxcroft, Maine

delivered at our creameries, and that it is not lack of knowledge but lack of interest. We see, then, that a deep interest in the work is the all important factor to success. This interest must be kept alive, either by love of the work itself or by thoughts of the income that it will bring. This appears to me to be the thing that will help us in solving the problem before us,—namely, how to improve the products of the creamery patron. As we look around us for the cause of failures and shattered hopes in the business world, we very often find that they are due to a lack of that personal interest and application to the work on the part of the managers which are so necessary to the success of any undertaking. It follows, then, that the first thing of importance is for the managers to convince the patrons that they are interested in their own part of the work, and to inspire them by their zeal and enthusiasm to do the best that is in them. We must try to stimulate and develop in the producers an absorbing interest in the work. How can this best be done? Among the many ways a few may be mentioned. Visit your patrons occasionally, and show by your conversation and manner that your are interested in the business and in them and their work. There is nothing equal to results to stimulate an interest; therefore, interest your patrons in the products of the creamery. Show them the difference in the results from good and poor cream, and that it takes good cream to make high priced butter; and that a high price for butter means a high price for cream. Make them feel that your interests and theirs are identical, and show yourself worthy of their confidence. In your efforts to look after the financial and commercial interests of the business, be strictly honest and just. In the words of our president, give them a square deal in everything. Another way is to exhibit the creamery products at the various places for exhibition, securing prizes whenever it is possible. This will help to show the patrons that you are doing the best you can with their products, and encourage them to give you better cream to work with. Perhaps it would be pardonable in me to quote some of our practices at the Waterford Creamery, in this connection. We have been fortunate enough to secure quite a number of prizes at the various exhibitions of dairy products, both in and out of the State. These have often amounted to quite a little sum. The question now arises, To whom should this money go? We settle the question by having

a meeting and a free dinner, to which the patrons and their wives are invited. We secure some of the interesting speakers on dairy subjects, to give us the most advanced thought and the results of experiments being carried on at our experiment stations as to the best methods of feeding and caring for the cows, ventilation, the care of the dairy products, and whatever else may seem to be of interest to the producer. This year we had for speakers Prof. G. M. Gowell, State Dairy Instructor S. C. Thompson, and ex-secretary B. W. McKeen. We have an orchestra, readings and discussions, and try in every way to make it a pleasant and profitable meeting to all. We also talk over the management of the business with the patrons, in order to find out if they are satisfied with the system that has been pursued and the rules adopted for governing them, and ask them to suggest changes that may seem to be desirable. The various questions are then put to vote, with the result that we always get a practically unanimous vote to do just the things that we have wanted to do. In this way we are united, since the patrons are working under their own rules, and give their co-operation and support in carrying them out. We enjoy these meetings very much and feel sure that they are of advantage to all concerned and that the patrons are much better satisfied for us to expend the money in this way than to put it into our own pockets or pay it to them in any other way.

Although working under the rule adopted by the Maine Creamery Association, of discounting defective cream three cents per pound, we seldom have occasion to do this, and when we do, we feel that the patron expects it of us and that all of the other patrons have a right to demand it. There may be other and better ways of interesting the creamery patron and improving his products. We should be very glad indeed to learn of them.

The last session of the Conference, on Thursday evening, was also devoted to the reading of essays by students of the agricultural department of the University of Maine, in competition for prizes offered at the Dairy Conference held at Pittsfield in December, 1905. These essays were of high merit, and were listened to with much interest. Music was also furnished by the students.

REPORT OF STATE DAIRY INSTRUCTOR.

To the Hon. A. W. Gilman, Commissioner of Agriculture:

I herewith submit my fourth annual report, as Dairy Instructor, for the year ending Dec. 31, 1906.

The year just passed has been a prosperous one for the dairymen generally. The prices have been particularly gratifying from the producers' point of view and conditions in general have been favorable to the producer, and a good feeling seems to exist.

During the year, I have done much work to protect the public against the use of adulterated and imitation dairy products, in accordance with the laws of 1905, and Mr. E. L. Cobb, Jr., of Portland, a former milk inspector in that city, has been employed a considerable portion of the time in making inspections of both milk and butter. We have made 1178 inspections of stores and taken 144 samples; 270 inspections of restaurants and taken 30 samples; we have also taken 257 samples of milk for chemical analysis and 136 samples for Wisconsin Curd Test analysis, or a total of 1841 inspections and 567 samples of both milk and butter.

We have examined butter in the following places: Auburn, Augusta, Anson, Bangor, Bar Harbor, Bath, Belfast, Biddeford, Brewer, Bridgewater, Brownville, Brunswick, Calais, Caribou, Cherryfield, Dexter, Dover, Eagle Lake, Eastport, Ellsworth, Fairfield, Farmington, Ft. Fairfield, Ft. Kent, Foxcroft, Gardiner, Greenville, Hallowell, Houlton, Island Falls, Kennebunk, Kittery, Lewiston, Livermore Falls, Machias, Madison, Mars Hill, Mechanic Falls, Millinocket, Milo, North Berwick, North Jay, Newport, Norway, Oakland, Oldtown, Old Orchard, Orono, Patten, Pittsfield, Portage, Portland, Presque Isle, Rockland, Rumford Falls, Saco, Sanford, Skowhegan, South Berwick, South Paris, South Portland, Springvale, Van Buren, and Waterville, sixty-four in all.

We have examined milk in Auburn, Augusta, Bangor, Bar Harbor, Bath, Belfast, Biddeford, Brewer, Brunswick, Gardiner,

Hallowell, Lewiston, Madison, Portland, Rockland, Saco, South Portland, and Waterville, eighteen in all.

The milk and butter inspection in this State has been sadly neglected, except when the Department of Agriculture has taken action and secured conviction in former years. Part of the cities have maintained a system of milk inspection, while another part have neglected to even appoint an inspector. The inspectors that have been appointed have in some instances done satisfactory work, while others have done but little or nothing towards correcting the evils which I have found to exist in certain localities. The conditions existing in certain towns and cities, in my judgment, warrant a better system of enforcement than they are at present receiving, for protection of health and lives of thousands of infants who are forced to use dangerous additions of foreign substance in their daily food, and no condemnation is too great for those officials who are supposed to be doing this work and under whose protection, milkmen are using adulterations. We have made prosecutions as follows: On Jan. 31, Henry J. Lessard and James N. O'Hara were before the Portland municipal court for serving oleomargarine to guests without notifying them of the fact. Cases were continued until Feb. 2, when the case against Henry J. Lessard was nol prossed and Bradford J. Roderick was substituted, who with James N. O'Hara pleaded guilty and were bound over to the May term of Superior Court, when they were duly fined. Sept. 27, John O. Burgess of South Portland was brought before the South Portland Municipal court on charge of selling milk to which formaldehyde had been added. He pleaded nolo contendere and was fined twenty dollars and costs. These prosecutions were aggravated cases, but we have tried to give everyone a full explanation of the law, so there could be no mistakes nor persecution. The work for the past two years has been largely of an educational nature, though the prosecutions had a very wholesome effect and certain conditions point to the probability of still more to follow.

During the first of the year, I made an inspection of Portland's supply of milk with the Wisconsin Curd test, the result being generally very satisfactory; the condition of the railroad milk was found to be very good for that class of product, so far as gases and odors were concerned, and the amount of total solids was up to standard and as good as we could expect. There are

always found many disadvantages in railroad milk; first, it is old when it reaches the consumer; second, it is brought over the road in ordinary cars in which it becomes warm and soon sours; third, milk raised as that is for the market on a large scale, is produced for quantity and not quality; fourth, it is produced so far away from local inspection that it is sometimes questionable, but the condition of all the milk in Portland was found to stand high in its class, some of it being evidently raised under fine sanitary conditions, though I would not give an impression that there was no need of better conditions or of closer inspection, for such is greatly needed.

About the first of March, the Portland Board of Health started out to enforce an ordinance requiring that all milk and cream should come from tuberculin tested cows, and while I acted only in an advisory manner, yet I was in close touch with their movements and in frequent consultation throughout a campaign which had many perplexing problems both to the board and the dairymen; but in the end, most difficulties were adjusted and as a result over 5,000 cows, all supplying the city, were tested, and in return the wholesale price of milk was increased about five cents per can which has worked greatly to the advantage of the producer, and the consumers feel that they can afford to pay the increased price for the better protection to health. While the work has not been perfect probably, yet on the whole, it seems that Portland has succeeded in doing a work which many other cities have tried with no better, nor as good success.

The cream situation in the State is more prosperous than ever before. The demand has steadily increased, and the past season was so hot that more cream has been sold during the past year than in any previous year.

The short supply and great demand has been the cause of raising the wholesale price received by the creameries and in turn the producers have received the highest prices ever paid, reaching in many instances to the extreme price of 33 cents per pound of butter fat for several months during the winter.

There has been an increase of six creameries in the State during the past year, all of which are a credit to the industry because they are substantial buildings, fully equipped, nicely finished and sanitary. The tendency to improve in this direction is particularly gratifying and speaks well for our manufacturers. The

work done at the creameries shows an improvement as well, both in quality of product and amount of business, while the work of the patrons has continued to improve as shown by the reports from the creameries in the amount of defective cream received.

The reports show an average increase of 8% in the amount of business done by the creameries and all but one report either no defective cream at all or a less quantity than last year, the decrease in some instances reaching 50 per cent. About 10% of all the creameries received no defective cream at all, while the average amount received is reported at 5% of the whole. From these facts, we learn that with one exception, the patrons are doing better work now than in former years, thus making the quality of all our product proportionally better, which, as I have shown in other reports, means more money to the producers, besides a better reputation for our State in the dairy world. The reports also show that our creameries sold more sweet cream in proportion to butter than formerly. For 1905, 6-11 of our product was sold as cream and 5-11 as butter, while this year 16-25 was sold as cream and 9-25 as butter. With the prospect of good prices and a good product to sell, there is no reason in sight why the creamery conditions should not improve and the business in this line increase.

In accordance with the increase in prices for the creamery product, has come an increase in price in most localities for home dairy products, which is very necessary to maintain an interest in the industry, since the prices of feeds and labor have so materially advanced; but so far as I know, customers have paid the advance willingly and feel that for quality they can afford to pay a reasonable price in comparison with all other material. We are still producing but a small proportion of the cheese that we consume and there is no tendency to increase in its manufacture, even at the high prices, though in certain localities, it could certainly be done profitably with a great saving of labor at the farms. We can expect but little increase, however, so long as the high prices for cream remain, with facilities for shipping from almost every part of the State, when the skim-milk can be kept on the farm and with no bother of delivering.

During the year, I have given considerable attention to the question of cow test associations, but I have not been able to assist in getting any into operation, much to my regret, for I

am convinced that in this way an opportunity is afforded to assist the dairymen to keep better and more profitable animals and thus make more profit out of dairying.

I find in looking up the statistics that in Denmark, where the idea originated, more than half the cows in the country are tested monthly through cow test associations, and the result shows a remarkable increase in production, even though the average yield in the beginning was almost double what it is in this country. I find that Canada has made a good start in forming associations with equally beneficial results, but so far, in this country, few associations have been formed, though all show good results. Michigan was the pioneer state and they seem well pleased. New England has but one, which from reports is very satisfactory. In our own State there seems to be an unfortunate condition existing, one which is hard to overcome. There is an average of about seven cows per herd, which if charged at a usual and seemingly fixed price of one dollar per cow would afford seven dollars per year for each herd and if a man was to visit and sample a different herd every night and morning for the month and repeat every month in the year, he would have but thirty herds, which at seven dollars per herd would amount to two hundred and ten dollars or about fifty-five cents per day, which amount is too small to insure competent men to do the sampling and testing. This unfortunate condition works much to the detriment of forming such associations, since the price has become a more or less uniform charge in all countries, though too small in connection with our own small herds to pay for having the work properly done. I hope however, that through some of the creameries, a man employed by them can do this work and put in enough time at the factory to make up for the pay which the test association cannot afford, and by that means accomplish what otherwise seems rather hard to bring about.

I have attended during the year, twenty-six meetings, including institute, grange and others, besides being with the University of Maine Farming Special for eighteen days and six days at our own Dairy Conference. I have attended the usual number of fairs, where I judged either dairy stock or dairy products. These were as follows: Maine State at Lewiston, Eastern Maine State at Bangor, Central Maine at Waterville, Waldo and Penobscot at Monroe, West Oxford Co. at Fryeburg, Sagadahoc

Co. at Topsham, Waldo Co. at Belfast and Piscataquis Co. at Foxcroft.

I have visited the creameries and many dairies during the year and find the sanitary condition of the former very good and many dairies are kept in the same good condition, but many are not so kept, though I hope and trust a better condition may gradually be brought about for the sake of a better and more wholesome product.

I have made tests for patrons in comparison with the creameries and some results tally very closely, while I am sorry to say that others are far from it and the results are not altogether satisfactory, but a solution of the difficulty is hard to find. There is a tendency on the part of some creamery managers to pay extreme prices for the product from the farms, and it naturally seems a benefit to the producers and should be so but the competition is so strong and every advantage taken to such an extent, that the profits in the business have been paid out. This condition is not altogether a healthy one, but I trust they will find some satisfactory solution without resorting to combinations or agreements, and without dishonest practices, though the farmers and dairymen should be alive to their own interests as regards the future and not live alone in the present. They should demand honest results and be satisfied with reasonable prices but oppose any combination of interests, except with honest, friendly competition and not drive the competition beyond that limit.

I desire to extend my thanks to the Commissioner of Agriculture, the officers of the Dairymen's Association and others, for the many kind suggestions offered and trust that the work of preaching the dairy gospel shall bring a full reward to all interested in agriculture in Maine.

Respectfully submitted,

S. C. THOMPSON.

MAINE FARMER PRESS, AUGUSTA

Shropshire Buck, No. 186288, two years old
Formerly owned by Chester P. Hamlin, East Wilton

REPORT OF STATE ENTOMOLOGIST.

To Hon. A. W. Gilman, Commissioner of Agriculture:

I have the honor of submitting my second annual report on the injurious insects of the State for the year 1906.

INTRODUCTORY REMARKS.

In some respects the season has been an eventful one as regards insect invasions. Letters of inquiry, asking for information on all kinds of insects, from the tiny eggs of plant lice to the American silk moth, *Samia cecropia,* have been received and answered. Cocoons of the above named moth were received from January 1st to June 4th, and again in the fall from August 29 to December 31. These came from almost every section of the State. The apple-tent caterpillar (*Malacosoma americana*) was reported as being very abundant in many localities. In some cases whole orchards were badly infested, large trees being stripped bare, not a leaf to be seen, the apples standing out as lone sentinels. In September the writer saw an average sized tree which had been stripped in early summer by the above named pest, trying to recover from the shock. It was putting out a few small leaves while here and there appeared a number of blossom clusters in full bloom. The chances are against the tree ever recovering from the shock.

The apple louse (*Aphis pomi*) was not as common this year as last, being reported from only a few localities. The cherry-tree ugly-nest (*Archips cerasivorana*) attracted a great deal of attention, as it appeared on many of the wild cherry bushes along the roadsides. Many specimens were sent in with the inquiry, "Is this a brown-tail moth's nest?"

The oyster shell bark louse (*Lepidosaphes ulmi*) had its usual run, with many an inquiry, "Is this the San Jose scale?" In

some localities the rose chafer (*Macrodactylus subspinosus*) did a great deal of damage to the apple crop.

The codling moth (*Carpocapsa pomonella*) was easily controlled by those who believe in and practice spraying, but where this was not done the usual loss in wormy apples was very apparent. The railroad worm (*Rhagoletis pomonella*) was reported as doing its usual amount of damage without any special effort on the part of the orchardists to control it. As the female fly deposits her eggs beneath the skin of the apple spraying will not avail. The only way is to keep the windfalls well picked up and fed out, or pasture the orchard to sheep or hogs; these will do the work to better advantage.

It has been thought that the pea louse (*Nectarophora pisi*) had had its day in Maine, but it was reported from several localities. The same was true of the bean weevil (*Bruchus pisi*). In 1905 it was generally reported the the Colorado potato beetle (*Leptinotarsa decemlineata*) was gradually disappearing but the past season has demonstrated this to be a fallacy. They were never so abundant or so difficult to destroy. A number of reports came in regarding the wooly aphis of the apple (*Schizoneura lanigera*), in almost every case on young trees which had been shipped into the State bearing a tag of inspection from some of the leading nurseries of the country. This will be more fully explained later on.

Tussock moths of both species, the white-marked (*Hemerocampa leucostigma*) and the old (*Notolophus antiqua*) have been very abundant in some sections, especially in the city of Portland. A lot of cocoons gathered in September yielded the following Hymenopterous parasites: *Pimpla inquisitor,* Say., *Pimpla conquisitor,* Say., *Theronia melanocephala,* Brulle, (the same as reported by Dr. C. H. Fernald in Bulletin No. 19 of the Massachusetts Station, as parasitic on the pupæ of the gipsy moth), *Pteromalus* sp., and several *Entedoninae* or chalcid flies.

On a visit to Prout's Neck, by request of the Improvement Society, to investigate the forest and insect condition, I found that universal pest, the mosquito (*Culex pipiens*) and a horse fly, the "green head" of the seashore (*Tabanus nigrovittatus*) very abundant. By proper drainage and the use of crude petroleum on all stagnant pools, both of these unwelcome guests could be very much reduced. Miss Edith Patch of the Experiment

Station, reported two species of the malaria mosquito, *Anopheles punctipennis* and A. *quadrimaculatus,* taken at Orono last summer. I am anxious to obtain any data on this subject and should be pleased to have specimens sent in for identification. The prevalence of mosquitos around our homes could be greatly reduced by a little care. The breeding places include stagnant pools, rain barrels, troughs, old tin cans, etc. If these places are properly looked after much of the annoyance due to these pests would be obviated.

ASSISTANCE IN THE OFFICE.

The work in the office increased to such an extent that it was found necessary to secure outside assistance; so that a clerk was employed for a few months during the summer. The correspondence was much larger than during the previous year. The large number of specimens sent in for identification required a great deal of extra time; the result obtained by so doing was very gratifying, as our efforts were much appreciated by those thus favored.

It was thought best to prepare some mounts showing the life histories of the brown-tail and gipsy moths to be donated to the normal schools and academies in the infested district. With this in view egg-clusters were collected, caterpillars inflated and moths prepared. These were arranged in Riker mounts and will be sent to the schools with the compliments of the department.

STATE COLLECTION.

The nucleus of a State collection has been formed and during the past season many of our most injurious insects were raised in the breeding cages so as to obtain the different stages in order to represent the life histories of such species. The names of voluntary correspondents are being secured from different sections of the State for the purpose of not only securing specimens for the cabinet but for the valuable information which will be obtained for future reports. The life histories of many of our most injurious insects are not fully known. The knowledge of this information and the remedy for their control would be of great value to our farmers and orchardists.

Many of the specimens sent in were placed in the rearing cages and kept on their food plant until they pupated. Some emerged

in the fall and the remainder were placed in cold storage awaiting their development in the spring. Among those raised were the following butterflies: A large colony of the Red Admiral (*Vanessa atalanta*) from larvæ taken on Seguin and Sawyer's Islands. In this lot was one specimen of *Aglais milbertii* and several specimens of Painted Beauty (*Vanessa huntera*); a few *Papilio polyxenes; Anosia plexippus;* and a number of colonies of *Euvanessa antiopa*. Of the moths:

Apple-tent caterpillar (*Malacosoma americana.*)
Cherry-tree ugly-nest, (*Archips cerasivorana*).
White-marked tussock (*Hemerocampa leucostigma*).
Old tussock (*Notolophus antiqua*).
Yellow-bear (*Diacrisia virginica*).
Corn stalk-borer (*Papaipema nitela nebris*).
Hickory tiger moth (*Halisidota caryae*).
Isabella tiger moth (*Isia isabella*).
American silk moth (*Telea polyphemus*).
Io moth (*Automeris io*).
Red-humped apple worm (*Schizura concinna*).
Yellow neck apple worm (*Datana ministra*).
Chain dotted geometer (*Cingilia catenaria*).

Special watch was kept for parasites and the following were obtained: On *Vanessa atalanta,* Diptera (*Exorista futilis* O. S.).

Vanessa cardui, (*Tetragonochara* sp.).

White-marked tussock (*Hemerocampa leucostigma*), Diptera (*Tachina mella*). (Hatched September 10th.)

White-marked tussock (*Hemerocampa leucostigma*), Chalcid fly (*Entedoninae*) *Papilio polyxenes, Trogus buccatus* Cr.

Cherry-tree ugly-nest (*Archips cerasivorana*) *Atrometus flavifrons* Ashm.

Cherry-tree ugly-nest (*Archips cerasivorana*) *Dichaetoneura leucoptera.* n. sp.

Red-humped apple worm (*Schizura concinna*) *Hemiteles* sp.

Red-humped apple worm (*Schizura concinna*) *Exorista griseomicans.*

Red-humped apple worm (*Schizura concinna*) *Exorista chelonia,* Rond.

Red-humped apple worm (*Schizura concinna*) *Limneria fugitiva,* Say.

Dagger moth (*Apatela dactylina*) *Rhogas intermedius.* (Hatched September 8th.)

Mourning cloak butterfly (*Euvanessa antiopa*) *Pteromalus vanessae,* Har.

Sphinx sp. *Pteromalus tabacum,* Fitch. (A hyperparasite on *Apanteles.*)

July 10th I took several pupæ of the brown-tail moth near Rice's bridge, York Corner, at Geo. B. Main's, which I thought were diseased. In a few days a number of hyperparasites emerged which were identified by Dr. L. O. Howard as a species of *Entelus.*

Aside from those above mentioned the different stages of the following were secured:

A number of species of the cut worms:

White grub (*Lachnosterna fusca*);

Potato beetle (*Leptinotarsa decemlineata*);

Pine borer (*Callidium antennatum*);

Cabbage butterfly (*Pontia rapae*);

Currant saw-fly (*Nematus ribesii*);

Carpet beetle or "Buffalo Bug" (*Anthrenus scrofularia*);

Meal worm (*Tenebrio molitor*);

Apple borer (*Saperda candida*).

The larvæ of quite a number of moths were inflated.

ACKNOWLEDGMENTS.

We are indebted to Dr. L. O. Howard, Chief of the Bureau of Entomology at Washington, D. C., and to members of his staff for determining numerous insects sent for identification, especially those of a parasitic nature, and for cuts used in illustrating this report.

To Mr. C. W. Johnson of the Boston Natural History Society for identifying the flies, (Diptera).

To Prof. A. H. Kirkland for photographs of gipsy work in Massachusetts.

INSECTS RECEIVED.

Dr. L. O. Howard kindly donated the following: Chinch bug (*Blissus leucopterus*); "Mexican Cotton Boll Weevil" (*Anthonomus grandis*) larva, infested cotton bolls and weevil,

cotton worm moth (*Alabama argillacea*) and cotton leaf showing work of young larvæ.

From Prof. H. A. Surface, State Entomologist of Harrisburg, Pa., seventeen year cicada (*Cicada septendecem*), pupa case, male and female adults, and twigs showing egg-cavities.

From Wilmon Newell, Entomologist, State Crop Commission, Baton Rouge, La., specimens of cattle tick (*Boophilus annulatus*).

From Prof. C. D. Smith, Experiment Station, Michigan, samples of the San Jose Scale, leaves and twigs from North Lansing, Michigan.

From Prof. R. I. Smith, State Entomologist, Atlanta, Ga., the following:

Lepidoptera.

Alabama argillacea.
Laphygma frugiperda.

Scale Insects.

Aspidiotus perniciosus. (San Jose scale.)
Aspidiotus hederae. (Oleander scale.)
Pulvinaria innumerabilis. (Cottony Maple scale.)
Pulvinaria acericola . (Maple scale.)
Aidacaspis pentagona. (W. I. Peach scale.)

Beetles.

Dynastis tityrus. (Rhinoceros beetle.)
Diabrotica 12-*punctata.*
Diabrotica vittata. (Squash beetle.)
Diplotaxis frondicola.
Cerotoma trifurcata.
Anomala binotata.
Euphoria sepulchralis.
Blepharida rhois.
Chalcodermus aeneus.
Calandra oryza. L. (Rice-weevil.)
Luperodes brunneus.
Conotrachleus nenuphar. (Plum-curculio.)
Leptinotarsa decemlineata. (Colorado potato-beetle.)

Bug.

Strachia histrionica. (Harlequin cabbage-bug.)

THE GIPSY MOTH IN MAINE.

HISTORICAL ACCOUNT OF THE MOTH.

The gipsy moth was known in Europe as far back as the year 1752, probably much earlier, but history does not record the fact. Since the above date, constant reference has been made to this pest in the history of insect invasions throughout the countries of Central Europe, portions of Asia, and Northern Africa. Large tracts in Russia have been entirely devastated in a single year. The caterpillars stripped the foliage of all kinds of trees and shrubs and caused the destruction of all field and garden crops. They were a menace to the health and comfort of the people in the infested districts. Several instances are on record in foreign countries where the caterpillars have actually driven people from their own homes. We have a similar record in several localities in Massachusetts.

This pest was first introduced into this country at Medford, Mass., in 1868 or '69 by a French Naturalist, Prof. Leopold Trouvelotte, for experimental purposes. Some of the caterpillars escaped from their confinement and spread to trees near by. The authorities were notified of this fact, but not realizing the full danger of their presence paid but little attention to the matter, and for twenty years they were allowed to spread unmolested save through the efforts of a few public spirited citizens who did what they could to stay their progress. By that time they had become such a menace that the attention of the State legislature was called to the situation and an urgent appeal made for state appropriation. This was finally granted and what is now known as the first commission was formed, and commenced work in 1890. This work was continued for ten years. During that time the state appropriation amounted to about one and a quarter millions of dollars, and probably nearly a like sum was expended by cities, towns and private individuals on their own property. There is no doubt that if the work could have been continued the ultimate extinction of the moth would have been accomplished; but for reasons best known to the legis-

lature, the appropriation was discontinued and the commission disbanded. The moth being left to recuperate very soon gained the ground already lost and far exceeded its former boundaries.

At the close of the commission the infested area was limited to about 250 square miles. In 1905, after four years of unmolested freedom save by the efforts of a few cities and towns, this area had increased to 2,224 square miles in Massachusetts; the moth had been conveyed to Rhode Island; to Stonington, Connecticut; into several towns in New Hampshire, and probably into Maine. In the spring of 1905, the legislature again took up the work with a determination to exterminate the pest if possible. The second commission was organized, with Prof. A. H. Kirkland as superintendent. An appropriation of $300,000 for three years was secured, together with $10,000 per year for the same time, the latter sum to be devoted to parasitic investigations. This work was placed under the supervision of Dr. L. O. Howard, Chief of the Bureau of Entomology at Washington. A laboratory was fitted up at Saugus, Mass., and parasitic material was obtained from several foreign countries. Some successful work has been accomplished during the past season, but to what extent these investigations may prove effective remains to be determined by further experiment. We have great hopes that these parasites may assist in the suppression, and that occasionally, when the seasons are suitable, some fungous disease may step in and help suppress the pest, although the above named agencies will never exterminate them.

During the session of the Fifty-ninth National Congress a bill was passed appropriating $82,500 to be devoted to staying the further spread of both the gipsy and brown-tail moths. Dr. L. O. Howard, who had the work in charge, appointed Mr. D. M. Rogers of Massachusetts, who was at that time Mr. Kirkland's first assistant, as special field agent for the suppression of the gipsy and brown-tail moths. Last July, work was begun in Massachusetts along the principal highways. The trees were cleaned of egg clusters and the sides of the road of underbrush in order to prevent the further spread by the caterpillars spinning down and being carried to uninfested territory. A crew was sent into New Hampshire to scout along the main travelled roads. Quite a number of colonies were discovered. In fact, the infestation was found to extend from the Massachusetts line to beyond Portsmouth.

The moth was discovered in Rhode Island at Providence in 1901, and, as little work was done to get rid of the pest, it has spread over most of the city and into some of the border towns.

In Connecticut the moth was first seen at Stonington, in 1905, extending over a small area. The thorough work done by the authorities has practically caused its extermination.

The last of July, 1906, word was received from Prof. A. H. Kirkland that it was desired to hold a series of meetings here in the State to consider the importance of concerted action in the infested states and to awaken an interest by meeting some of the leading citizens and talking over the situation. As a result it was arranged to hold three meetings, namely, at Portland, Augusta and Bangor. The meeting at Portland was held at the West End Hotel on August 6th. Dr. Howard and Prof. Kirkland were met by Hon. A. W. Gilman, Z. A. Gilbert and the State Entomologist. These three gentlemen accompanied their guests during the entire trip. The others in attendance at the meeting were Hon. Amos Allen, Col. F. E. Boothby, president Frank B. Milliken and secretary Morris C. Rich of the Portland Board of Trade, Mrs. Wm. S. Denny of the Civic Club, A. W. Smith of the Park Commission, L. C. Bateman of the Lewiston Journal, C. S. Phinney, E. E. Philbrook, several reporters and other gentlemen whose names do not appear. The subject was quite thoroughly gone over and much interest was manifested. It was a very profitable meeting to all concerned.

The meeting at Augusta was held in the rooms of the commissioner of agriculture at the State House at 10 A. M., August 7th. It was quite largely attended. In addition to a number of those mentioned above were Gov. Norman J. Colman of Missouri, Hon. Parker Spofford, E. E. Ring, L. T. Carleton, ex-mayor Chas. S. Hichborn. Miss Mabel Connor, Hon. Josiah Bassett, Prof. W. L. Powers, Mr. B. F. W. Thorpe of the Maine Farmer, Arthur I. Brown and a number of others.

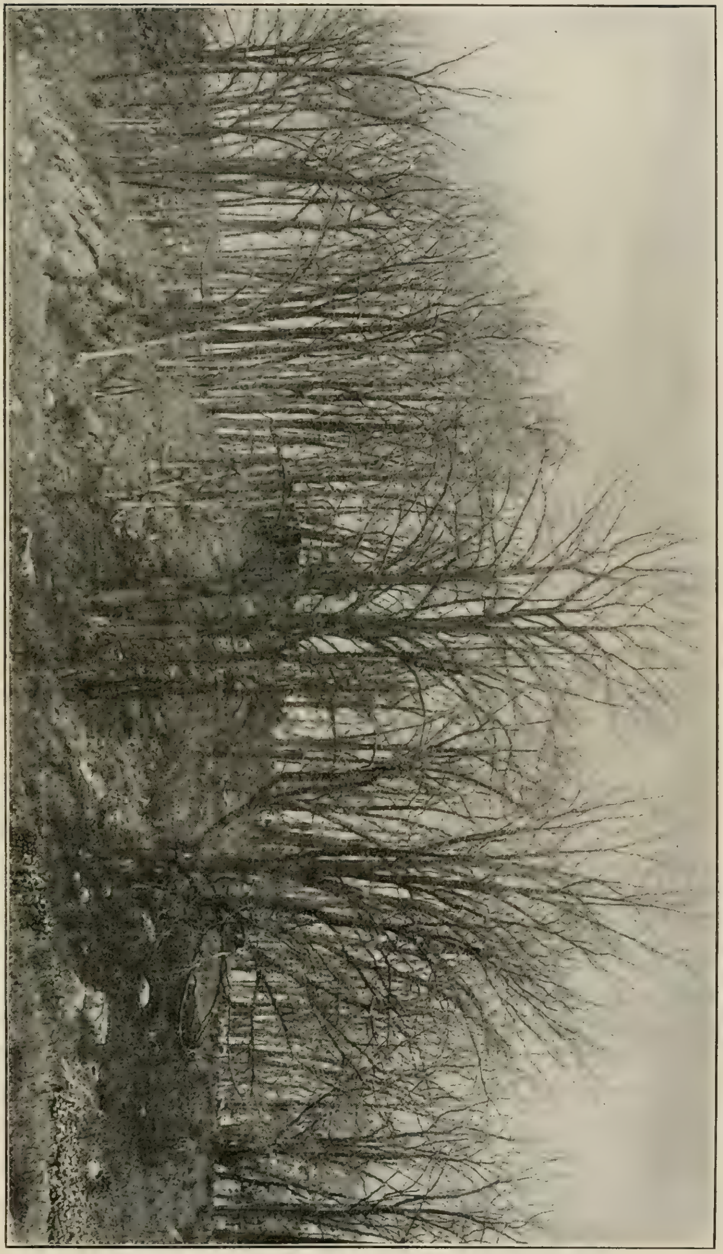
Much was said regarding the work in Massachusetts and all expressed the opinion that active measures should at once be taken to arouse public sentiment in the matter.

In the evening of the same day, the third and last meeting was held at the Bangor House. In addition to the first named party, the following were present: Hon. Isaiah Stetson, president of the Board of Trade, secretary E. M. Blanding, Hon. E.

E. Ring, Hon. Geo. E. Macomber of Augusta, J. F. Garrity, S. L. Boardman of the Bangor Commercial, Dr. Chas. D. Woods, Prof. W. D. Hurd and Miss Edith M. Patch of the University of Maine, J. E. Bunker, Chas. F. Payne, Wm. Miller and Mr. Walz of Bar Harbor, A. L. Reed of Northeast Harbor, and others. Letters were read from Hon. Eugene Hale, Dr. Geo. E. Fellows and Hon. A. T. Wiswell, regretting their inability to be present on account of previous engagements.

At this meeting Dr. Howard promised to send a scouting party in the early fall to ascertain if the gipsy moth had invaded the State. Those present at the several meetings expressed their appreciation to Dr. Howard and Prof. Kirkland for their interest and active co-operation in an endeavor to arouse public sentiment in favor of a much needed legislation not only at the National Capital but in the different infested states as well.

In November Mr. Rogers sent a scouting party which began operations in Kittery on the 20th, with the intention of making a thorough inspection from Kittery to Portland along the main routes taken by the automobiles on their way from Massachusetts to different points in Maine. The inspection gave the following results: Kittery, 226 new egg clusters and 8 old; Eliot, 27 new; York, 182 new and 8 old; Wells, 47 new and 3 old; Kennebunk, 9 new and 2 old; Kennebunkport, 3 new and 1 old. The old nests indicate that the moths must have been here at least the year before. By the time Biddeford was reached the snow was too deep to continue, so that the work was suspended until later in the spring when it will be again resumed and the total area of infestation determined.



Hardwood trees stripped by Gipsy Moth Caterpillars. (From photograph obtained by courtesy of Prof. A. H. Kirkland.)

In the meantime several men were sent to Massachusetts by request of Mr. Rogers, to learn the business, and afterwards were employed by him in inspecting the principal cities east of Portland. By the time Ellsworth, Bangor, Waterville, Augusta, Hallowell, Rockland, Bath and Brunswick were finished, the snow was too deep for further work. One egg cluster was taken on the grounds of the Soldier's National Home at Togus, a caterpillar or moth having evidently been brought there by a soldier returning from the infested district in Massachusetts at the expiration of his furlough. This shows how easily a new infestation might obtain a foothold before being discovered by the authorities from the department.

So much for history. Now for the live issue of the day, and how best to meet and solve the problem that confronts us. The past history is no dream. It is a stubborn reality, and no idle words or even a grave discussion of the situation can set aside the necessity for the adoption of prompt and drastic measures to rid our State of this most unwelcome guest. Strenuous efforts must be put forth by every loyal citizen of the State.

LIFE HISTORY OF THE GIPSY MOTH.

There are four distinct stages in the life history of this insect, namely, the egg, larva or caterpillar, pupa and adult or perfect moth. The accompanying cuts are life size.

EGG CLUSTER.

The eggs are deposited in masses of from three to five hundred in a cluster. These are laid during the period from the last of July to the middle of August. The eggs are very small, the cluster (Fig. 1) averaging about an inch in diameter, of irregular outline, flattened and covered with a yellowish, felt-like substance which comes from the body of the female during the process of laying the eggs. As the female moth is a very weak flyer, these eggs are not deposited on the leaves as are those of the brown-tail moth, but are placed on the trunks of the trees, on the under side of large limbs, very often hidden away under rocks, brush-piles, fence rails and holes in trees, in fact, in any out-of-the-way place where the moth can crawl in and be unmolested. These eggs do not hatch until the following spring when

the leaves are sufficiently developed to furnish food for the young caterpillars.

FIG. 1. Egg Cluster of Gipsy Moth.

LARVA OR CATERPILLAR.

The young caterpillars hatch from the first to the middle of May. They are so small as not to be seen by the casual observer, as they crawl up the trees. They are almost black in color, with very slight bodies about one-twelfth of an inch in length, covered with numerous hairs. As they grow they shed their skins, or moult, several times before reaching maturity. In the advance stages, the most of the feeding is done during the night. They reach their full growth from the first to the middle of July, depending upon the season. They are then large, robust looking caterpillars (Fig. 2) from 2½ to 3 inches in length, varying

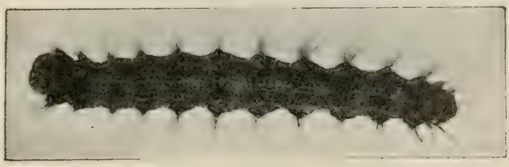


FIG. 2. Larva or Caterpillar of Gipsy Moth.

in color from a light to a very dark brown. There are three light yellow broken lines extending the whole length of the body, one in the center of the back and one each side, with a row of tubercles between. There are six rows of elevated tubercles along the body, each one bearing a tuft of hairs of varying lengths. The first four pairs of tubercles on the third to sixth segments inclusive are of a bluish color, the remaining ones are red. The head is prominent, light yellow, marked with two distinct, almost vertical black dashes, the rest being finely sprinkled with the same color. The long hairs of the second segment project well forward in front of the head.

PUPA.

When full grown these caterpillars crawl down from the trees and often away to some secluded place where they spin a few silken threads, enough to hold themselves in place, and change to the pupa form (Fig. 3).

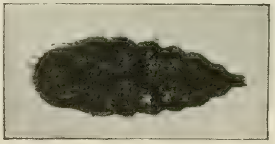


FIG. 3. Pupa of Gipsy Moth.

The pupa, as indicated above, is not enclosed in silk so as to be hidden from view, but is attached to the small end and held in place by a few threads. It is of the usual reddish brown color, sprinkled over with short hairs. The male pupa is much smaller than the female, on account of the latter containing so many eggs.

THE MOTH.

The male moth (Fig. 4) varies from a light to a dark brown

FIG. 4. Male Gipsy Moth.

color, the fore wings being spotted with darker shades. The hind wings are of a uniform light brown color darker on the veins. The body is slender and tapering to the end, without a tuft. The wings expand about 1½ inches. The moth is an active flyer, usually appearing before the female and flies by day as well as night.

The female (Fig. 5) is very light, almost white in color, with very thin, semi-opaque wings, the fore wings being marked with a row of brown spots along the margin and several irregular wavy lines and spots of the same color over the body of the wing. The hind wings are uniformly light, with a somewhat indistinct, marginal row of brown spots between the veins. The body is unusually large for a moth of the same wing expanse, which accounts for its inability to fly. The end of the body terminates quite abruptly and is covered with light brown or yellowish hairs, which are used in covering the egg clusters. The antennae of the female are slender, while those of the male are quite broadly feathered, brown in color. Those of the female are black.

FIG. 5—Female Gipsy Moth.

Soon after mating, the female moth deposits her egg clusters, as previously described, and then dies. The insect remains in the egg stage about nine months of the year; is active in the caterpillar stage, the only time it is doing damage to vegetation, for about two months. This period is through May and June, the pupa and adult stages lasting the remaining month. These stages may vary to quite an extent, depending upon the season. I have stated about the average time for each.

MANNER OF SPREADING.

The principal means of spreading this pest is by the different forms of conveyances that pass through or out of the infested district. The caterpillars have a habit of spinning down by silken threads and remaining suspended in mid-air, where they can be readily caught up by passing vehicles and carried in many cases to remote localities before being dropped. The colonies in New Hampshire and Maine were undoubtedly started from caterpillars caught up by automobiles coming through the infested district in Massachusetts. They may be carried from place to place in the egg cluster or even in the pupa stage. Moths could deposit the egg clusters in empty egg crates, in side-tracked freight cars, on lumber, cord-wood, or even stove wood in an open shed. One family living in the infested district of Massachusetts where the caterpillars had been crawling over their wood-pile moved into this State bringing their wood with them, and if the authorities had not been notified and the wood burned, a colony might have been started and gained a strong foothold before being discovered.

For this reason, as has been already stated, every citizen of the State has a duty to perform to keep a vigilant watch in his locality for any form of insect new to him and send any such doubtful one to this office for identification. In this way a new colony could be located and destroyed before gaining much headway.

The situation in Maine is a serious one, but we feel confident that extermination may be possible, provided sufficient aid is rendered from the infested district, together with what we may expect to receive from the National Government.

The plan of campaign in all the infested states should be to quarantine each district, thus preventing further spread, and then gradually narrow this area until extermination is secured. This to some may seem visionary and wholly impracticable, but we cannot succeed unless the effort is made. The old adage, "Where there's a will there's a way," ought to apply to the case in hand. The experiment is worth our best effort, and if success is reached the expenditure will be well worth the price of that success.

INJURY DONE TO VEGETATION.

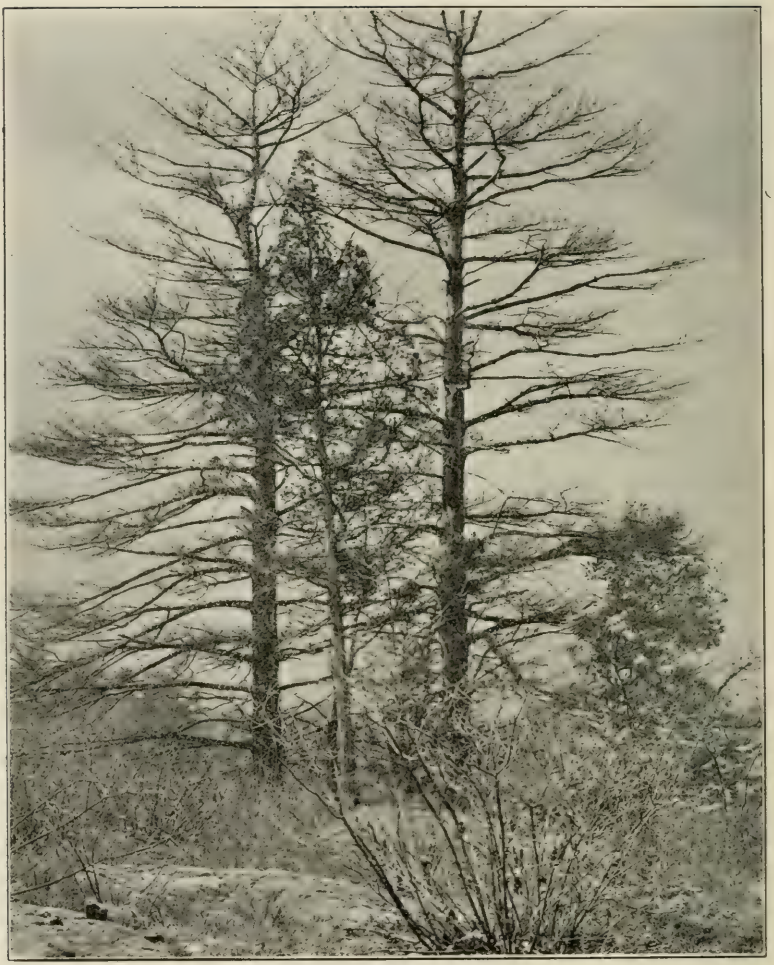
The food plants of this almost universal feeder include practically the whole flora of the country. That is, hardly a plant, tree or shrub, is immune from its attacks. Like the brown-tail it seems to prefer the fruit trees, as the apple, pear and plum, but from these it readily passes to the shade and forest trees, taking in its course not only all of the deciduous trees but the evergreens as well, even to the cedar. If it should secure a hold in northern Maine who could estimate the loss to our State in dollars and cents!

METHODS OF CONTROL.

The first method is to destroy the egg clusters. This is done by saturating them with a creosote mixture. If one attempts to remove the eggs he is liable to scatter some on the ground. The caterpillars hatching from these might go unobserved through the season while those from a whole egg cluster would be numerous enough to attract attention, and could then be destroyed by spraying. The scattering ones might give a number of moths to deposit egg clusters for another season.

The second method is to capture the caterpillars by tying strips of burlap around the trees with a portion folded down over. As the caterpillars are night feeders, they would crawl under this loose fold and remain in hiding during the day. These bands should be visited at least once a day and the larvæ killed. Of course all do not seek these places of hiding, but many do, and in sections where there are but few egg clusters the most of them would be captured during the season before the caterpillars reach maturity. All cavities or holes in tree trunks should be closed by filling them with Portland cement or by covering them with pieces of zinc. All underbrush along the road should be cleaned up and burned, as it offers good hiding places for the caterpillars or for the moths while laying their eggs.

I would recommend that each town employ a reliable man to clean up the sides of the highways, removing all brush, wild cherry (which harbor black knot), scrub apple trees, etc. This would not only destroy the breeding places of many of our noxious insects but would be removing unsightly objects and add to the appearance of the roadside as well.



Evergreen trees stripped by Gipsy Moth Caterpillars.
(From photograph obtained by courtesy of Prof. A. H. Kirkland.)

The Brown-Tail Moth.

(*Euproctis chrisorrhoea.*)

This moth has had a noted history in the entomological literature of Europe for the past 300 years.

A single egg-cluster, or a winter nest was imported from Holland about the year 1890, to Somerville, Mass. From the above as a nucleus, this noted pest has extended its domain until at the present time it stands as a menace to five out of the six New England States.

The work done by our cities, towns and private individuals during the campaign of last year was highly creditable to the public spirited enthusiasm of our loyal citizens, but it will never do to stop here.

AREA INFESTED IN 1906.

The area established in 1905 extended over about 4,000 square miles. York and Cumberland counties were entirely infested except two or three towns in the northwestern part.

Sagadahoc county was entirely infested.

One town in Oxford county, the southern portions of Androscoggin and Kennebec counties, the most of Knox and Lincoln, seven towns in Waldo, and from Bucksport in Hancock county to Columbia Falls in Washington county.

The spread along the northern boundary has been principally on the western half; while east of Bucksport there has been but a very slight northern spread.

At the close of this year, 1906, the whole of York, Cumberland, Androscoggin, Sagadahoc, Lincoln and Knox counties were infested. The following towns in Oxford county were more or less infested: Porter, Hiram, Brownfield, Sweden, Waterford, Norway, Hebron, Paris, Buckfield, Hartford, Sumner and Woodstock.

One nest was taken at Wilton; this was the only nest reported in Franklin county.

In Kennebec county in addition to last year's infestation a few nests were taken in Fayette, Readfield, Mount Vernon, Belgrade, Monmouth, Sidney, Waterville, Vassalboro, China and one nest in Winslow.

In Waldo county the northern boundary of infestation extends through the towns of Liberty, Searsmont, Belmont,

Belfast, Searsport and Stockton Springs. About the same as last year.

By an examination of the map one can see that the increase in territory over last year has been mostly in a belt extending across Oxford, Androscoggin and Kennebec counties.

We are much gratified at what has been accomplished.

It is true that in some localities as many nests will be taken this winter as last, and in the towns where there was a slight infestation many more may be gathered.

On account of their rapid increase, if a single nest was overlooked in a border town, where only a few were taken last spring, it might mean the finding of from 50 to 150 nests during the coming winter.

THE WINTER NESTS.

For the benefit of those who are unfamiliar with the nests of the brown-tail moth I will add a brief description of the same.

The nests are constructed by the small caterpillars to serve as homes to protect them from the severity of our northern winters.

The eggs of the moth are laid about the last of July; these hatch into very small caterpillars during August.

These caterpillars, when young, remain in a colony, feeding together on the leaves of their food plant. They are so small that it only requires a few leaves to satisfy their hunger, and they only remove the green chlorophyl from these leaving the skeleton. These few leaves are firmly fastened to the twig by means of a fine silk secreted by the caterpillars for this purpose. Within these leaves a tough silken membrane is formed within which they construct small silken cells where they pass the hibernating period.

These nests are generally located on the outer tips of the new growth, and as they are firmly attached will remain all winter if not molested.

FIG. 6. Winter Nest of Brown-tail Moth.

It is an easy matter to identify them as the silken attachment is plainly visible on examination and is generally seen at quite a distance owing to its appearance.

It will thus be seen that the time for active and economic work against the pest is during the fall, winter and spring months while the trees are bare of their foliage.

One great mistake, however, will be in leaving the work until spring as the caterpillars will crawl out during the first warm days of April to feed on the buds.

As this report will come into the hands of many who were not able to secure a copy of the report for 1905 it seems at this time best to give a short life history of this pest.

LIFE HISTORY.

The eggs are laid in clusters about one inch in length, and are usually deposited on the fresh leaves near the tips of the branches. These clusters contain from 150 to 500 eggs; 50

nests counted averaged 319. They are covered with the brown hairs detached from the tuft of the abdomen during the process of laying.

The choice of food plants is varied, as they are found on all of our fruit trees, most of the shade trees and many of our deciduous forest trees. They will not feed on the evergreens.

As stated above the caterpillars do but little harm to the trees during the fall, as they are simply getting ready for the hibernating period of winter. But in the spring as soon as the buds start they are ready for work. As they grow they shed their skins, or moult, several times, feeding rapidly and spreading over the tree as they grow, so that most of the damage to the trees occurs during the months of May and June.

THE CATERPILLAR.

The caterpillars reach their growth about the last of June. They then average about one and three-fourths inches in length. The body is of a dark slate color, approaching a brownish-black in some cases.

There are irregular yellow and orange markings scattered over the body, also a double broken dorsal line of the same colors.

The tubercles are black, from which project long reddish-brown hairs. The hairs on the second segment project well forward over the head. Tufts of short white hairs occur on the upper edge of the medial row of tubercles, extending from the fifth to the twelfth segment inclusive, eight on each side.

These white patches along the sides are the characteristic markings for this caterpillar and will readily distinguish them from other species. On each of the tenth and eleventh segments is a round orange-red dorsal tubercle with a depressed center.

The larvæ on reaching maturity seek some convenient place in which to pupate. They then proceed to spin a few silken threads, just enough to retain them in place. Throwing off their caterpillar skins they appear in the usual pupæ form; being of a reddish-brown color, from five-eighths to three-fourths of an inch in length.

The moths hatch about the middle of July and deposit their eggs as above stated, thus completing their life cycle.

THE MATURE INSECT.

The head, thorax and wings of the moth are pure white; abdomen white next to the thorax, gradually changing to dark brown toward the posterior end; tapering in the males, retaining its size in the females, and ending abruptly in a large tuft of golden-brown hairs from which it derives its name "the brown-tail moth." The antennae are white above, light brown underneath. The under anterior edge of the fore wing in the male is dark brown. Expanse of wings from one and one-eighth to one and one-half inches.

The moths are nocturnal in their habits, flying by night, and are attracted to a light. As they are strong flyers it would be possible for them to fly long distances before depositing their eggs.

This accounts for the extensive territory they have covered during the past few years.

The injuries in the case of the brown-tail caterpillar are two-fold, one as a destroyer of vegetation, the other as a menace to the health and comfort of the human family. When the caterpillars molt, or shed their skins, the fine hairs which are covered with spines are readily carried by the wind or even float in the air, and these coming in contact with the moist surface of the body, break up, and working under the skin produce a very painful eruption, which has received the name of the "brown-tail itch."

This in many cases is a very serious matter, and had not the work of last spring been so thoroughly accomplished our resort towns would have suffered a great loss in being deprived of the revenue derived from our summer visitors.

MANNER OF EXTERMINATION.

As will be seen from the above description of the nests, they are quite conspicuous objects, and can generally be seen for some distance.

The only way to clear up the nests is to cut and burn them. By means of a pair of pruning shears attached to a long pole the most of the nests can be secured. Then by means of extension ladders the rest ought to be reached.

It will not do to depend on a brush fire to destroy the nests as it requires a great deal of heat to penetrate the silken cells. They should be burned in a stove or furnace.

Apple-Tree Tent Caterpillar.

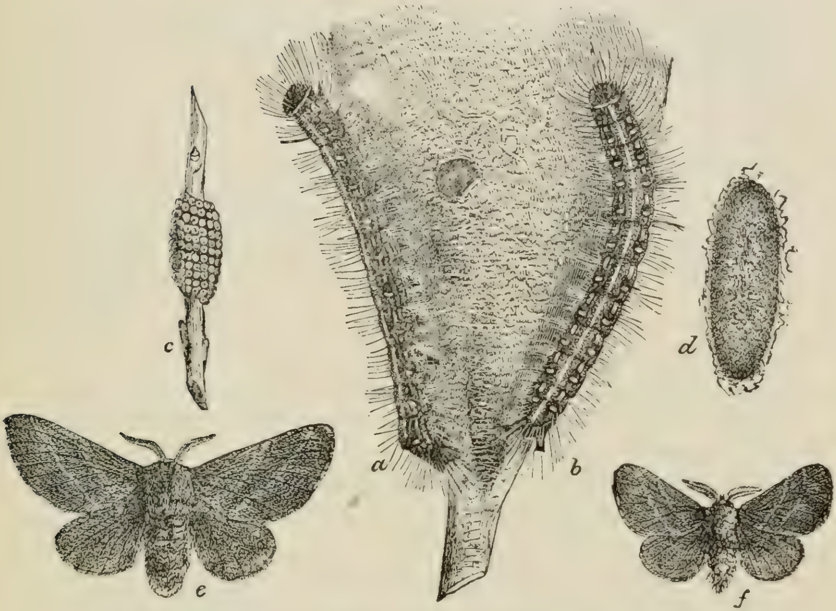
(*Malacosoma americana.*)

It would seem that the above named insect was altogether too numerous, and its life history had been published too many times to need another description here. But owing to the many inquiries regarding its egg-clusters and to their having been taken for those of the brown-tail moth, I think it best to produce a cut of its different stages and give a life history of the same. For a number of years the unsightly "tents" have been on the increase in many sections of the state. One can drive but a few miles into the country during May and June before he will observe their nests on the wild cherry and scrub apple trees along the roadside. And very often, even with the knowledge that they are causing a great loss to the apple crop, our orchardists will let them go unmolested from year to year thus aiding their increase. It is an easy matter to get rid of the pests. The most effective method is to collect and burn the egg-clusters which can readily be seen after the leaves are off the trees in the fall, or at any time through the winter. A good time would be in the spring when the crust would hold, on a day when the sun was not too bright as the reflection on the snow would soon tire the eye. With a pair of pruning shears on a pole the egg-clusters could be easily removed.

If the eggs are not gathered the young caterpillars should be destroyed as soon as their tents are observed. This can be done at night when the caterpillars are all in the nest. Make a swab of a piece of cloth and fasten to the end of a pole, dip this in kerosene oil and burn out the nest.

LIFE HISTORY.

Like the brown-tail and gyspy moth they pass through four stages.



APPLE TREE TENT CATERPILLAR.

FIG. 7. *Malacosoma americana;* a, b, caterpillars; c, egg-mass; d, pupa; e, female; f, male. (Riley. Bulletin 34, Div. of Entomology, U. S. Dept. of Agri.).

EGG CLUSTER.

The egg-cluster is deposited around the twig in a cylindrical mass, about two hundred in number. They are varnished over with a glue-like substance which glistens in the sun, and are quite easily seen. These remain from the time they are laid in July until the following May when they hatch into very minute caterpillars.

LARVA OR CATERPILLAR.

These little caterpillars are gregarious in their habits, feeding together and constructing a silken tent-like structure generally in the crotch of the limbs. They feed during the day and return at night to the nest. They grow quite rapidly and reach maturity about the middle of June. It seems wholly unnecessary to describe the caterpillar as this stage is so well known. The distinguishing mark which will separate the Apple-tent caterpillar from the Forest-tent is in the line extending along the center of the back; in the Apple-tent the line is continuous, in

the Forest-tent it is broken, a dash on each segment of the body. After reaching maturity they crawl from the trees and seek some convenient place to pupate.

COCOON.

These are about one and one-fourth inches long and one-half inch in width, rounded at each end and made of white silk heavily sprinkled with a yellowish-white powder. Within this the caterpillar throws off its skin and appears in the usual pupa form.

ADULT OR MOTH.

The moths hatch in about two weeks. The female is of a light brown or buff color; the male is darker, a broad band of a lighter shade extending across the fore wings. The female measures about one and one-half inches across the extended wings, the male is smaller.

The moths are night fliers and often attracted to a light, especially the males. Many might be caught and destroyed, but as they are almost wholly males this method would not be economical. Soon after appearing the female moths lay their eggs for another generation.

STRAWBERRY WEEVIL.

(*Anthonomus signatus, Say.*)

In my last annual report brief mention was made of this pest. As it has been reported from several sections of the State, I have though best to give a short description of the insect. It has been known for more than 35 years as an enemy to the strawberry plant. It first appeared in Maryland in 1871, and has gradually been working north. In 1885 it did extensive damage to the strawberry field on Staten Island, N. Y., and a year or two later appeared in several localities in Canada. In later years this pest has caused the loss of almost the whole crop in some localities, amounting to many thousands of dollars to the strawberry growers.

As shown in Fig. 8, 9, the adult insect is a small, slender beetle about one-tenth of an inch in length, with a long curved snout to which are attached its antennæ. It is of a reddish-black color with a dark spot on each wing cover.

LIFE HISTORY.

The beetles appear before the strawberry bloom. The female punctures the bud and deposits an egg in the opening thus made. She then cuts the stem just below the bud so that it droops and finally falls to the ground. Here it is kept moist so that the young grub can feed until it reaches maturity. The eggs are laid only in the buds of the staminate varieties, as the young grub lives entirely on the pollen. In about a week from the time the eggs are laid the minute grubs hatch and begin feeding on the pollen. As they grow larger if there is not sufficient pollen they eat the corolla and other portions of the bud. When the larvæ reach maturity they form a cavity within the bud and change to the pupæ. This stage lasts about a week or ten days, when they emerge as a mature beetle. The whole period from egg to adult lasts about a month. The rest of the year is taken up in basking in the sunshine on the blossoms of flowers for awhile, and then they disappear to hibernate until the following spring.

FIG. 8. *Anthonomus signatus;* adult beetle from side, enlarged. (Riley.)

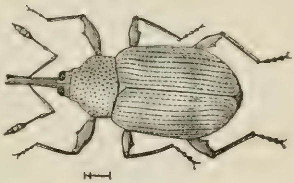
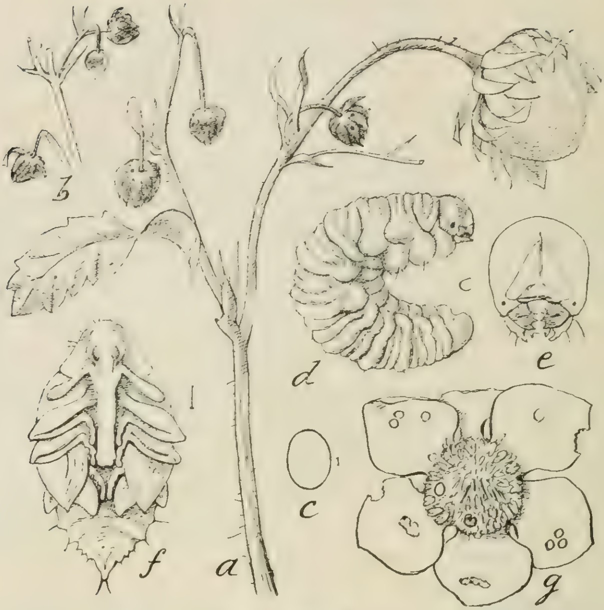


FIG. 9. *Anthonomus signatus;* abult beetle enlarged. (Chittenden.)

The life history is illustrated by Fig. 8, side view; Fig. 9, top view; Fig. 10, a. b. strawberry spray showing work in bud and stem, natural size; c, outline of egg; d, larva; e, head of larva much enlarged; f, pupa; g, open bud, showing egg on left and puncture made by snout of beetle on petals. (F. H. Chittenden.)



STRAWBERRY WEEVIL.

FIG. 10. *Anthonomus signatus;* a, b, strawberry spray showing work in bud and stem natural size; c, outline of egg; d, larva; e, head of same; f, pupa; g, open bud showing location of egg on left and punctures made by snout of beetle on petals; c, d, f, g, enlarged; e, still more enlarged. (Chittenden. Annual Report of the U. S. Dept. of Agri. 1892).

REMEDIES.

As the life cycle is passed within the bud, spraying will not avail. Careful search should be made for this insect especially on new plants obtained out of the State, and at its first appearance the plants infested should be destroyed, if only a few in number, or the ground be thoroughly gone over and cleaned up of buds, leaves, etc., and this material burned to destroy the eggs or young larvæ. This was the method recommended in the case of Mr. Herman Corbet of Farmington, whose strawberry bed was infested in 1905. The treatment was effective in that case.

THE SAN JOSE SCALE.

(*Aspidiotus perniciosus.*)

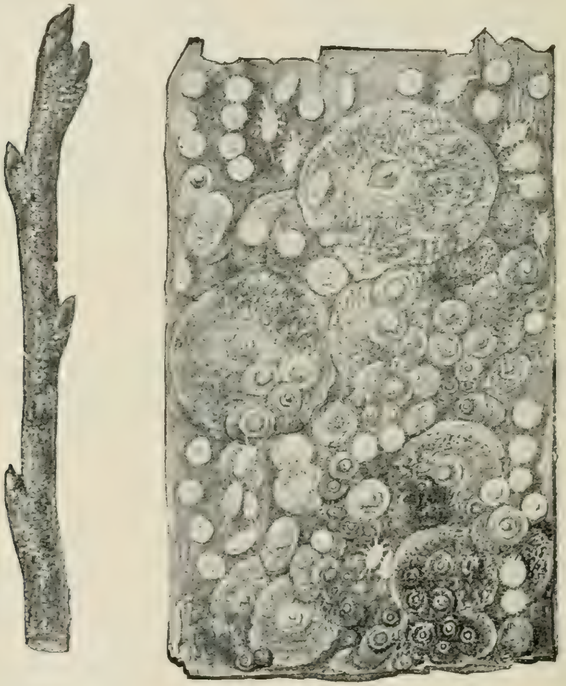
Although this scale has not made its appearance in the State as far as I know yet I deem it wise to give a description of this most pernicious pest to our orchard interest so that a more careful and thorough search may be made for it by our farmers and orchardists, and a strict watch kept and its appearance reported as soon as discovered. There is no other insect that so threatens our fruit trees at the present time. Even the gipsy and brown-tail moths cannot compare with it in destructiveness, and as to methods of control or suppression it is much more difficult to handle. On account of its minute size it might easily pass unobserved even by the most diligent search of a careful observer, unless he is familiar with the insect. Every orchardist in the State is especially requested to send in a specimen of any infestation of a doubtful character which may be found.

The origin of this scale was a source of varied conjectures until the years 1901 and '02 when Prof. C. L. Marlatt of the Bureau of Entomology at Washington was sent to China and Japan to investigate. After a careful search he discovered that its original home was in China. It was evidently brought to this country on infested trees, shrubs or fruit. It was discovered in the San Jose valley, California, in 1780 and described in 1880 by Prof. J. H. Comstock who gave it the name of the pernicious scale, *A. perniciosus.* Since then it has gradually spread south and east until now it is found as far south as Florida, north into British Columbia and east to Massachusetts. It was first discovered in Massachusetts in 1895 and now sections are quite badly infested especially around Boston. So that we have every reason to fear its not far distant advent into this State.

Some have thought that it could not stand the rigors of our northern winters, but so some of the wise ones predicted of the gipsy and brown-tail moths; but the last few years have abundantly proven the falsity of this proposition, and we may yet live to see this other pest among our already too numerous insect enemies.

LIFE HISTORY.

As usually found on the tree or shrub they appear as very small, somewhat circular scales, irregular in outline, and when mature, somewhat resembling a miniature volcanic cone. They are so small as to appear indistinct to the naked eye and a pocket lens is needed to determine them. When young they are of a grayish white color, turning darker with age. Fig. 11 in the cut gives a good illustration of them showing the natural size and magnified.



a *b*

SAN JOSE SCALE.

FIG. 11. *Aspidiotus perniciosus;* a, infested twig, natural size; b, bark as it appears under hand lens, showing scales in various stages of development and young larvæ (Howard and Marlatt. Bulletin 62, Div. of Entomology, U S. Dept. of Agri.)

If abundant these scales overlap as do those of our common oyster-shell bark-louse, and the surface is rough to the touch, the tree has lost its thrifty appearance and soon dies. As the

life history has been worked up very carefully by Dr. L. O. Howard and C. L. Marlatt of the Department at Washington in "Bulletin No. 3 New Series" I take pleasure in quoting from that.

"In common with all the armored scales, the life round of this insect, with the exception of a few hours of active larval existence and an equally brief winged existence of the mature male, is passed under the protection of a waxy scale. The winter is passed by the nearly full grown insects under the protection of the scale. Early in April in this latitude (Washington) the hibernating males emerge, and by the middle of May the overwintered females mature and begin to give birth to a new generation, continuing to produce young for a period of upward of six weeks, when they reach the limit of production of young and perish. The viviparous habit of the giving birth to the living young, possessed by the San Jose Scale, finds a parallel in many other insects. In the case of the San Jose Scale the eggs are fairly well formed within the body of the mother."

"The emergence of the young from the female over a period of six weeks leads to a very confusing intermingling of generations and renders it difficult to make observations on the life history. The newly born larva (Fig. 12) is an almost microscopic creature of pale orange-yellow color, with long, oval body and with the customary six legs and two feelers. They measure about .24mm. by .1mm. in width. The long thread-like proboscis with which the juices of the plant are sucked up is doubled on itself and lies in an invagination of the body wall, the tip only projecting."

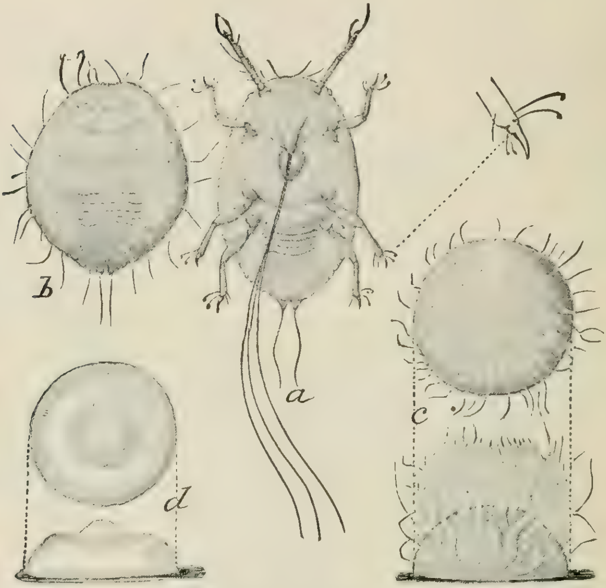


FIG. 12. *Aspidiotus perniciosus;* a, young larva and developing San Jose scale, showing sucking beak with setae separated, with enlarged tarsal claw at right; b, dorsal view of same, still more contracted, with the first waxy filaments appearing; c, dorsal and lateral views of same; somewhat contracted, illustrating further developement of wax secretion; d, later stage of same, dorsal and lateral views, showing matting of wax secretions and first form of young scale. All greatly enlarged. (Howard and Marlatt. Bulletin 62, Div. of Entomology, U. S. Dept. of Agri.).

"After crawling about for a few hours, the young larva settles down and slowly works its long, bristle-like sucking beak through the bark, folds it antennae and legs beneath its body and contracts to a nearly circular form. The development of the scale begins even before the larva becomes fixed. The excretion starts in the form of very minute white fibrous waxy filaments, which spring from all parts of the body and rapidly become more numerous and dense (Fig. 12 b, c). Within two days the insect becomes entirely concealed by the white or pale grayish-yellow shell or scale, which now has a prominent central nipple (Fig. 12 d). In the early history of the scale it maintains its pale whitish or grayish-yellow color, turning gradually darker gray. The male and female scales are exactly simiiliar in size, color and shape until after the first molt, which occurs twelve days after the emergence of the larva. With this molt, however,

the insects beneath the scale lose all resemblance to each other. The males (Fig 13 a) are rather larger than the females, and have large purple eyes, while the females have lost their eyes entirely. The legs and antennae have disappeared in both sexes. The males are elongated and pyriform, while the females are almost circular, without organs except a long sucking bristle springing from near the centre beneath. Eighteen days from birth the males change to the first pupal condition (Fig. 13 b) and the male scales assume an elongated oval. The female undergoes a second molt about twenty days from the larva." "The effect of the sucking of the insect is now quite apparent on the young growth, causing the bark to assume a purplish hue for some distance around the central portion contrasting strongly with the natural reddish green of the uninjured bark."

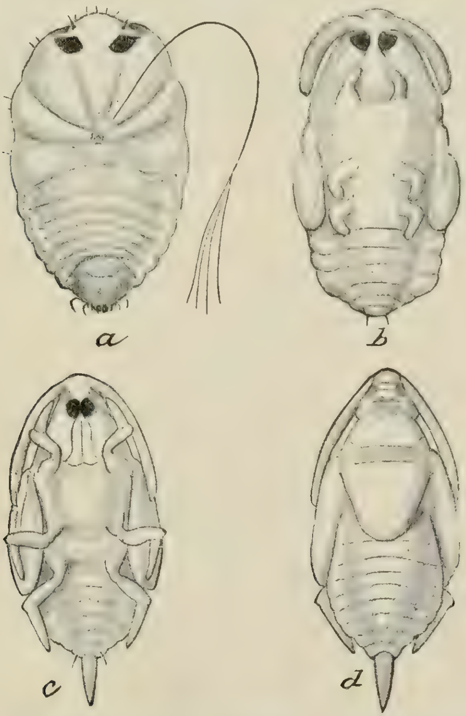


FIG. 13. *Aspidiotus perniciosus*; development of male San Jose scale; a, ventral view of larva after first molt; b, same after second molt (pro-pupa stage); c and d, true pupa, ventral and dorsal views. All greatly enlarged. (Howard and Marlatt. Bulletin 62, Div. of Entomology, U. S. Dept. of Agri.)

"About twenty days after birth the male insect transforms to the true pupa. The true pupa (Fig. 13 c, d) is pale yellow, darkest about the base of the abdomen. From twenty-four to twenty-six days from birth the males mature. They seem to issue chiefly by night or in the evening. The mature male (Fig. 14) appears as a delicate two-winged fly-like insect."

"Thirty days from birth the females are full grown and the embryonic young may be seen within their bodies. The adult females, prior to the development of the young, measure 1 mm. in length and a little less in breadth, and are pale yellow with transparent spots near the margin of the body (Fig. 15). The length of a generation is determined by the females and covers a period of from 33 to 40 days."

"The fully developed scale of the female is circular, very slightly raised centrally, and varies in diameter from 1 to 2mm., averaging about 1.4mm. The large, well-developed scales are gray, excepting the raised central portion which is of a yellowish color. The mature male scale is oblong-oval, nearly twice as long as wide, and averaging in length about half the diameter of the female scale."

FIG. 14. *Aspidiotus perniciosus*; adult male, greatly enlarged. (Howard and Marlatt. Bulletin 62, Div. of Entomology, U. S. Dept. of Agri.)

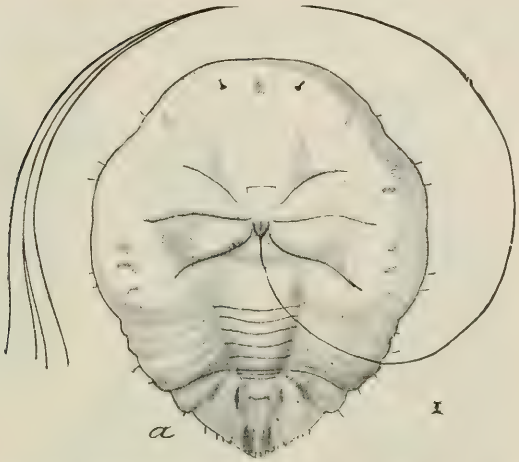


FIG. 15. *Aspidiotus perniciosus;* adult female San Jose scale, before development of eggs; a, ventral view, showing very long sucking setæ. (Howard and Marlatt. Bulletin 62, Div. of Entomology, U. S. Dept. of Agri.

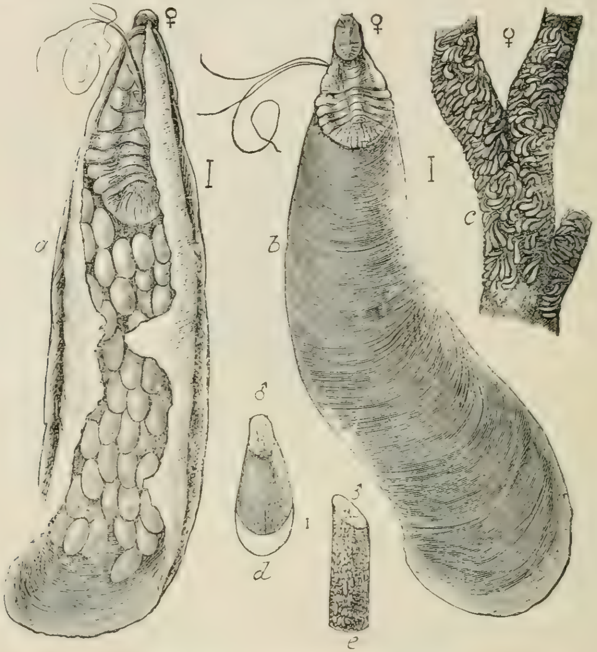
Four or five generations were recognized at Washington. In summing up the progeny of a single female from spring to fall the number of individuals amounts to from 1,500,000,000 to over 3,000,000,000. The females are continuously producing young from the middle of May to early frost so that the young may be found running over the trees at almost any time during the summer. For this reason it is very difficult to handle them, in fact almost an impossibility. The only sure way is to have all nursery stock subjected to the hydrocyanic acid gas treatment before being set.

APPLE-TREE BARK-LOUSE.

(*Lepidosaphes ulmi.*)

A brief description of this our most common scale may not be out of place when we consider that hardly a farmer with a half-dozen trees or an orchardist with his acres, with all that has been written on the subject, takes the pains to try to get rid of this easily handled orchard pest. It is a well known fact that this insect destroys many thousands of trees in the state. Its life history is known to only a comparative few, for the simple reason that the majority do not take the pains to even read the literature on the subject. I have so many speci-

mens of this common pest sent in that I have thought best to illustrate the life history and give a short description of the



OYSTER-SHELL BARK LOUSE.

FIG. 16. *Lepidosaphes ulmi:* a, b, females; c, scales on twig; d, male scale. (Howard. Bulletin 31, Div. of Entomology, U S. Dept. of Agri.)

same. The cuts are self explanatory. It is easily recognized by being oyster shaped, thus the name, although the male scale is much smaller and does not have the peculiar curved shape like the female. During the fall and winter the eggs may be found safely hidden under the scale. In the early summer these hatch into minute freely crawling young lice. They wander about over the tree and in a short time locate on the twigs and branches, becoming fixed; a new scale forming over them. The males alone have wings. The females lay their eggs in September, dying soon after. There is but one brood each year in Maine.

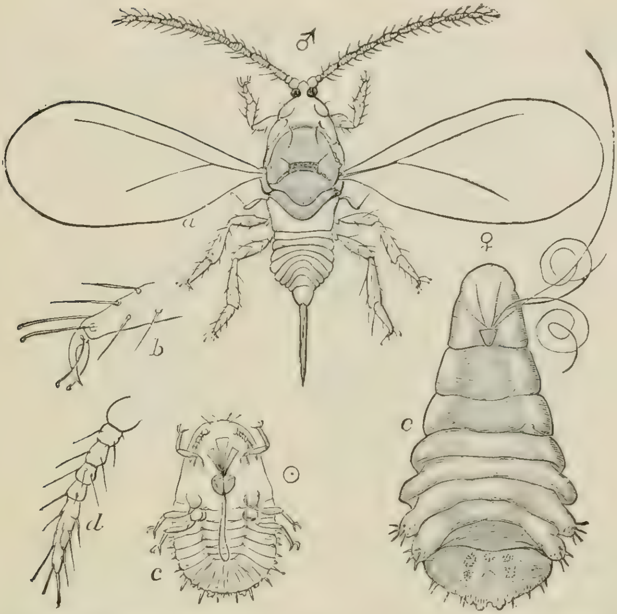


FIG. 17. *Lepidosaphes ulmi*; a, male; c, larva; e, female; b, and d details. (Howard. Bulletin 34, Div. of Entomology, U. S. Dept. of Agri.)

Remedies:—They can easily be destroyed by thoroughly washing the trees during the fall, winter, or spring with whale oil soap solution, or spraying the trees at the time the young hatch out, before they get fixed on the tree, with kerosene oil emulsion.

The Woolly Aphis of the Apple.

(*Schizoneura lanigera*).

As this pest is being introduced here from year to year from nursery stock coming from several houses in New York as well as other states it seems high time that some action be taken to protect our interests. It is quite evident that it is gaining ground as it has been reported from many new localities during the past year.

My attention was first called to this insect in the state several years ago. A lot of 500 New York trees were purchased and paid for before being delivered. The party that bought them discovered that some of them looked unhealthy and before set-

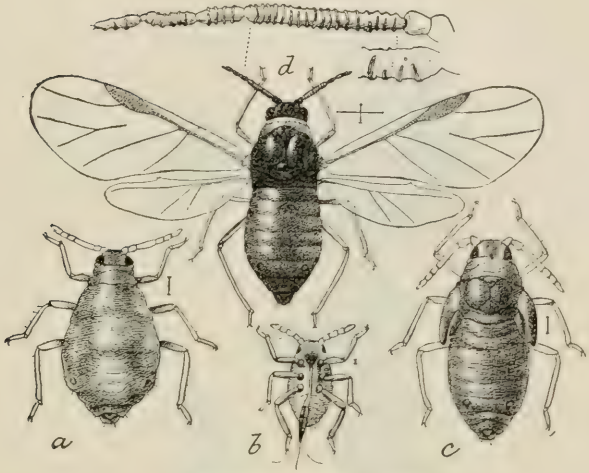
ting them asked my advice regarding the lot. By examination out of 500 trees 50 were infested with the galls of the woolly aphis. These were laid aside and the nurserymen were notified; no notice was taken of this and a second letter was sent. The only reply was that the trees were all right and no rebate could be allowed. Since then I have met with several parties who have been served in just the same manner.

The state of Maine has been the dumping ground for the stock of many unscrupulous nurserymen. I inspected several lots that were sent in last summer and one lot of several hundred contained one hundred second quality trees of the Stark variety which were just crawling with this pest. Colonies were on the roots as well as on the branches. These had been on the road for some time and were late arriving so that the conditions were favorable for their development. The trees were condemned and destroyed.

Last August while inspecting the fruit trees in one of our leading nurseries I discovered the aphis on a block of apple trees. On investigation found that it was confined to all the trees ordered last spring from a leading nursery outside the state. As a matter of experiment the trees were immediately taken up and exposed for 40 minutes to the Hydrocyanic treatment. The trees were then reset. Another spring will tell whether the treatment was a success as far as the life of the trees is concerned. The above trees bore a certificate of inspection from the state inspector. Our orchardists must learn to recognize this pest so that when they receive trees for setting they can know by inspection if they are infested. For this reason I herewith give the life history of this insect.

LIFE HISTORY.

The woolly aphis is shown in its different stages in Fig. 18 a, agamic female; b, larva; c, pupa; d, winged female (Marlatt), in Fig. 19, a, b, work on roots; c, a louse highly magnified. (Marlatt.)



WOOLY APPLE APHIS.

FIG. 18. *Schizoneura lanigera;* a, agamic female; b, larva; c, pupa; d winged female. (Marlatt. Bulletin 34, Div. of Entomology U. S. Dept. of Agri.)

They are small, reddish-brown lice, and as generally seen, are covered with a long white woolly substance. These appear in patches on the limbs of the trees, often resembling mildew in general appearance. They also live in colonies on the roots of the same tree, where they form gall-like swellings of varying sizes as shown in Fig. 19. They are much more destructive when found on the roots as they sap the life of the tree directly at its source.

The insect passes the winter either in the egg-form in crevices in the bark of the trunk, or in the adult stage in the gall-like formations on the roots.

In the spring the eggs hatch producing the agamic female Fig. 18, a, and these give birth to living young as do those of the San Jose scale. This continues through the summer when the winged form appears, Fig. 18, d. These fly to other trees and produce male and female lice; the females of these lay eggs from which the new generation starts the following spring.

The lice generally congregate around the scar produced by the pruning of a limb or where an injury has occurred to the bark.

FIG. 19. *Schizoneura lanigera;* a, b, work on roots; c, a louse. (Marlatt. Bulletin 34, Div. of Entomology, U. S. Dept. of Agri.).

REMEDIES.

The best remedy for those on the trunk and limbs is a 10 per cent solution of kerosene oil.

Those on the roots are much more difficult to get rid of. If trees have been set but a few years so there is but slight root expanse, the carbon bisulphid treatment would work to good advantage if care is exercised so as not to kill the tree.

The result of the experiment tried at Bar Harbor will be given in my next report.

Insects of the Year.

Schizura concinna.

The red-humped apple worm was very abundant during the season, being reported from almost every section of the State. A great deal of damage was done by them, especially to young trees. Hundreds of trees set late last spring were stripped of every leaf during the month of August. Of course these trees would not leave out again during the season, and the chances are that the most of them will not survive the winter. This pest has been on the increase for several years but its parasites (See page 176) were quite abundant this year and it is hoped that they have got the better of it. Unfortunately the caterpillars appear at just the wrong season of the year, when the orchardist is not looking for any trouble from an insect invasion, and before he knows it the damage is done. The eggs are laid in a cluster on the under side of the leaf. The young caterpillars are gregarious in their habits, feeding together side by side on the leaf. They grow rapidly and reach maturity in a few weeks, disappearing as quickly as they came. They go into the ground to pupate and remain in that stage until the next season. The best way to get rid of them is to go over the trees when they first appear and remove the leaf or cut off the twig that they are on and destroy them by burning.

Hemileuca maia.

Colonies of H. maia have been located at Surry, Orland and Fryeburg. Quite a number of the moths were sent in from Surry and were supposed to be the brown-tail moth on account of the reddish tuft at the end of the body.

Calosoma scrutator.

A fine specimen was taken at Seguin Light July 23rd. It was crawling on the iron rail around the light; it was evidently attracted to it the night before.

Datana intigerrima.

September 7, in company with Mr. H. A. Jackson, I drove to West Portland on the Buxton road about four miles from Portland. I found seven hickory trees from eight to twelve inches in diameter and forty feet tall, completely stripped of leaves by the above named caterpillar. As it was late, I found but few

larvæ, but the trunks of the trees had large patches of the cast skins of the caterpillar still hanging.

Proctacanthus rufus.

July 21st a fine pair of robber flies were taken at Popham Beach. Mr. C. W. Johnson of the Boston Natural History Society stated that this was the most northern record for this fly.

Chrisophanus thoe.

Several specimens of this rare butterfly were captured at York Beach July 12 by Miss Marian Moss of Washington, D. C.

Peyotettix glacialis.

Specimens of this wingless grasshopper were sent in by Geo. R. Howe of Norway. They were taken on Speckled Mountain.

Catocala relicta.

This beautiful birch catocala was very abundant during the past season. A large number were taken during September.

Ennomos magnarius.

This geometrid moth was much more abundant than has been recorded for years. Many specimens of the caterpillar taken from the apple trees were sent in during the season.

Tolype vellida.

An unusual number of this lappet moth was taken in Waterville and they were reported as being very common in other sections.

Fenisica tarquineus.

Owing to the unusual abundance of the alder woolly aphis (*Schizoneura tessellata*) last year the above named butterfly has had one of its cycles of abundance, and occurred this season in great number; the larvæ of the butterfly feeding upon the aphis.

For the same reason the Syrphus flies, the larvæ of which feed on the same, have been very plentiful, especially *Syrphus ribesii.*

Telea polyphemus.

The larvæ of this silk moth were taken in large quantities. Mrs. Chas. Lewis of Portland reported it as being found on Sawyer's Island by the hundreds. Mrs. V. P. DeCoster of Buck-

field took a large number which were found feeding on the gray birch.

Samia cecropia.

This moth has also been much more abundant than for years. A large number of cocoons were sent in.

Automeris io.

Hundreds of the males of this beautiful moth were captured at night during the early summer. Many larvæ of the same were sent in for identification.

Pteronus ribesii.

The currant saw-fly has been as abundant as usual. This pest can be easily controlled by spraying with Paris green when it first appears.

Halisidota caryae.

The hickory tiger caterpillar was very abundant during the late summer and fall and large numbers were sent in for identification. They were found feeding on the following:

Apple, cherry, elm, oilnut, hazel, willow, alder, birch and witch hazel.

Euvanessa antiopa.

The caterpillars of this butterfly, commonly called the "Mourning Cloak," have not been so abundant for years. Like the red-humped apple worm it has been on the increase. Several specimens of the parasite, *Pteromalus vanessae,* were obtained from larvæ taken from the field. This caterpillar feeds on the elm, willow and poplar. The mature butterfly hibernates through the winter. A colony hatched from the breeding cages as late as September 28.

Apatela dactylina.

This caterpillar, commonly found on the alder, was sent in from a number of localities. It was thought, by many, to be the gipsy. So anxious were they regarding the pest that all kinds of "crawling things" were forwarded to the department for identification. The parasite *Rhogas intermidius* destroyed a large number of the caterpillars.

Papaipema nitela nebris.

The corn-stalk borer was reported from several localities as doing damage to the corn, especially the sweet variety. The

caterpillar bores into the stalk near the ground or at the angle of a leaf and eats out the centre of the young plant or ascends the stalk and destroys the newly formed ear.

Panchlora poeyi, Sauss.

A fine specimen of this southern cockroach was taken on Water street, Augusta, last summer. It was of a light green color, the edge of the wings being a lighter shade. The specimen was sent to Washington and retained by the department.

Insect Investigation.

Private Estates.

Many requests have been made by parties owning real estate at our resorts for an inspection of the trees and shrubbery on their lawns and private estates. This has been done to some extent on occasions when requests have come from improvement societies for an inspection of parks and public drives.

Our summer visitors are much interested in the natural scenery of our island and coast towns and are anxious that the trees be kept free from disease and insect depredation.

Orchard Inspection.

We had hoped to be able to devote more time to this feature of the work during the season just passed. Yet we have been able to accomplish much in this line. Several orchards have been inspected with good results, but the truth remains the same that but very few of our orchardists realize the importance of the proper care of their trees.

The apple industry in Maine is just in its infancy. Its possibilities are beyond our present comprehension, our practical knowledge is slight indeed, our pet theories have been but visionary ideals. But today we stand on the threshold of the economic problems that face us and see in the near future the absolute necessity of success to be attained by the persistent ana thorough application of modern methods to fruit culture in Maine.

Like many another line of farming we have been only too willing to follow in the footsteps of our predecessors and have been satisfied to accept the consequences and feel that we have done our whole duty when we have purchased a lot of cheap trees, set them in cheap holes, in cheap ground, and do not even know enough to feel cheap at the inevitable results that are sure

to follow such a method of procedure. Instead of being theorists we must become systematists by using our applied science and eliminate all of the errors of theory and practice and place our profession, as does the merchant or manufacturer, on a standard scientific system.

One of the most important factors in the successful prosecution of the orchard industry is the proper control of our insect enemies. There are hundreds of these insects that prey upon the apple tree, either in the root, trunk, bark, twig, leaf, blossom or fruit. Some of the more important ones are the round head borer, *Saperda candida;* the flat headed borer, *Chryobothris femorata;* the bud moth, *Tmetocera ocellana;* oyster-shell bark-louse, *Lepidosaphes ulmi*; Red-humped apple worm, *Schizura concinna*; Apple maggot, *Carpocapsa pomonella*; Railroad worm, *Rhagoletis pomonella.*

We also have the fungus diseases, the apple scab and dry rot to contend with. The most of these can be easily controlled by spraying at the proper time. The others can be handled after learning their habits, by a study of their life histories.

Farming Special.

A "Farming Special" was run over the Bangor and Aroostook Railroad in April and another over the Maine Central in June. They were under the supervision of President Fellows of the University of Maine. One of the features of the exhibit was a collection of specimens illustrating the different orders of insect life. It represented many of our common injurious forms as well as some beneficial ones. Among others the life histories of the gipsy and brown-tail moths were given.

This collection attracted a great deal of attention and was the means of disseminating much valuable information and arousing an interest in our insect pests that will ultimately lead to greater success in the control of them by our farmers and orchardists.

Exhibitions at Fairs.

Several requests were made for a collection of injurious insects to be placed on exhibition at the State Fairs. Two dozen Riker mounts were prepared showing the life histories of many of our most injurious insects including the brown-tail and gipsy

moths. These were exhibited at the three State Fairs, Bangor, Lewiston and Waterville; also by special request at the Franklin County fair at Farmington and at the Sagadahoc County fair at Topsham.

A great deal of interest was taken in these exhibits. The most of the time two were in attendance to explain the specimens and answer the many questions that were asked relative to the best methods to be employed to control our different insect pests. Many requests were made for the bulletin on the brown-tail moth, and at the close of the exhibits over 400 of them had been sent out; this was in addition to our regular mailing list.

Nursery Inspection.

The inspection of the nurseries in the state during the past year has revealed the fact that our nursery-men are, as a rule, alive to the insect situation and are endeavoring to keep abreast of the times in their warfare against these pests. Also to keep their stock up to a high standard of perfection, both as to grade and appearance.

I herewith give a list of the nurseries reported with a brief summary of their location, extent and stock.

Ernest Saunders, Florist, Lewiston, Maine.

He has been disposing of his nursery stock for several years and is carrying only a few ornamental hardwood trees and acts as agent for a local fruit tree trade. Stock in good condition. Has extensive greenhouses.

Hancock County Nursery, located at Surry, Maine. Seven miles from Ellsworth, owned by John G. Davis.

It has been running but a short time, and carries a small line of apple, pear and shade trees together with small fruits such as gooseberry and currant bushes, strawberry plants, etc.

Herbert A. Jackson, Forest City Nurseries. P. O. address 144 Westbrook St., Portland, Maine.

This nursery carries a large stock of evergreen and deciduous trees, shrubs, roses and other plants.

McCabe Bros., Dealers in Nursery Stock, Bangor, Maine.

They act as agents for all kinds of nursery stock including small fruits and carry but a small stock of apple trees and hardwood shade trees.

E. T. McCabe, Palmyra, Maine.

Acts as general agent for nursery stock but keeps on hand a small supply of apple and ornamental trees, shrubs and rose-bushes.

The Maine Nursery Co., Hampden, Maine.

It has been established but a short time and has a large available acreage with about twenty-six acres already planted. The plan is to enlarge this each year until the limit is attained. The stock consists of fruit trees and all kinds of small fruits; ornamental and shade trees; and hardy perennials. It has a fine location with all kinds of soil adapted to the growth of every variety of plants.

The Mt. Desert Nurseries, Bar Harbor, Maine.

The main nursery located at Bar Harbor consists of about twenty acres, one acre in fruit trees, four in evergreens, six in deciduous trees, shrubs and vines, seven in hardy perennials, and two in annuals.

The annuals are grown for cut flowers, the hardy perennials are sold mainly outside of the state, the trees, shrubs and vines are sold mainly within the state.

The branch at North East Harbor contains about three acres, one and one-half acres to annuals and hardy plants, and one and one-half to evergreen trees, deciduous shrubs and vines.

These nurseries are in fine condition, free from injurious insects and fungus diseases.

The above list is very small in comparison to the size of the state; there may be several others but these are all that have reported. There are many who are engaged in the strawberry industry. We have not had time to investigate to any extent but since the advent of the strawberry weevil is known an effort will be made to locate and inspect all places where small fruit stock is grown for nursery purposes. We earnestly desire that all growers of such stock shall report to the department, both for their own and their patrons' protection.

For a state the size of Maine our nursery facilities are wholly inadequate to meet the demands made upon them, especially in the line of fruit trees. It is true that the conditions in the state are not as favorable as are those in New York and some of the states farther west. Yet we believe that good native trees are much more desirable, for the reason that they are more hardy. Home production should be encouraged, why not in the line of fruit

trees? There is a constantly increasing demand for apple trees. If we could raise our own there would be no danger of the San Jose scale or the woolly aphis; these will come in on imported stock. The latter is here already and the former will get here all too soon unless climatic conditions are against it. We trust that this may be so but do not dare to relax our vigilance in an endeavor to ferret out its hiding place if it once crosses our border.

Partial Record of Specimens Sent for Identification.

Jan. 8. F. S. Graves of Waterville sent in a cocoon of the cecropia moth (*Samia cecropia*).

Jan. 11. From C. L. P. Handy of Albion, three egg clusters of the white-marked tussock moth (*Hemerocampa leucostigma*.

Jan. 22. Two cecropia cocoons were sent by C. H. Seirman of North East Harbor.

Jan. 26. A cluster of white-marked tussock moth eggs was received from W. A. Alexander, Ellsworth.

Jan. 26. J. E. Bunker, Bar Harbor, sent in a cecropia cocoon.

Jan. 26. From P. B. Friend of North Sedgwick several brown-tail moth nests (*Euproctis chrysorrhoea*).

Jan. 26. Some brown-tail moth nests were sent in by Robert H. Pottle, Seal Cove.

Jan. 29. A cluster of white-marked tussock moth eggs was sent in by Miss Florence E. Hamblin of Tremont.

Jan. 30. Received from Mrs. Geo. P. Homer of Bucksport a cluster of white-marked tussock moth eggs.

Jan. 30. A cluster of old tussock moth eggs was received from Chas. F. Clark of Castine.

Jan. 31. The following were sent in by C. H. Seirman of North East Harbor: Three fine cecropia cocoons, one tussock cocoon, two polephemus cocoons (*Telea polyphemus*).

Feb. 1. G. W. Whitney of North Newburg sent tussock egg cluster and three female tussock moths (*Hemerocampa leucostigma*).

Feb. 2. E. L. Totman of Ashdale sent several nests of the brown-tail moth.

Feb. 2. An egg cluster of the tussock moth was received from T. J. Lowell of East Denmark.

Feb. 26. A. L. McCorrison, Searsmont, sent some brown-tail moth nests and several egg clusters of the tussock moth.

Feb. 27. An egg cluster of the tussock moth was sent in by Mrs. J. F. Knowlton of Ellsworth.

Feb. 27. From Philip S. Melcher of Portland, a cluster of white-marked tussock moth eggs and a specimen of the oyster-shell scale (*Lepidosaphes ulmi*).

Feb. 28. John F. Lear, V. S., Lamoine, sent egg clusters of both the old and the white-marked tussock moths (*Notolophus antiqua*), (*Hemerocampa leucostigma*).

Mar. 1. Received from D. H. Knowlton of Farmington terminal shoots of the apple, infested with a gall fly.

Mar. 10. J. L. Small of Stonington sent a nest of the brown-tail moth.

Mar. 10. A polyphemus moth cocoon was sent in by C. B. Sylvester of Hudson.

Mar. 12. F. P. Bailey of Harpswell sent eggs of white-marked tussock moth.

Mar. 14. An egg cluster of the tussock moth was received from Wilder C. Snell of Oakland.

Mar. 20. L. W. Seavey of Long Cove sent a brown-tail moth's nest.

Mar. 25. Received from Carrie Fuller of Rockport an egg cluster of the tussock moth.

Mar. 28. Alonzo Butler, Union, sent in a nest of the brown-tail moth.

Mar. 29. A brown-tail moth nest from J. E. White, Columbia.

Mar. 30. From E. L. White of Bowdoinham a cecropia moth and cocoon.

April 3. C. E. Grendell, South Penobscot, sent three egg clusters of the white-marked tussock moth.

April 5. One cecropia cocoon (*Samia cecropia*) and two egg clusters of the tussock moth were received from W. L. Withers, Oakland.

April 5. A. T. Gillis of North Bluehill sent an egg cluster of the tussock.

April 7. C. W. Finnimore of Fairfield sent in two egg clusters of the apple tent caterpillar (*Malacosoma americana*).

April 7. Mrs. Augusta A. Leach, Penobscot, sent in three egg-clusters of the white-marked tussock moth.

April 9. Two egg-clusters of the tussock moth were received from Mrs. E. N. Winterbotham of Lamoine Beach.

April 10. Mrs. M. W. Paul of Kittery sent in an egg-cluster of the white-marked tussock moth, a cecropia moth cocoon (*Samia cecropia*), fifty brown-tail moth nests and one cocoon of the promethea moth (*Callosamia promethea*).

April 16. William Spiller, Waterville, sent beetles (*Tribolium confusum*) which were found in oat-meal.

April 17. A cecropia cocoon was sent in by J. L. Lowell of Auburn.

April 26. John G. Davis, Surry, sent three egg-clusters of the tussock moth.

April 27. Edwin D. Bartlett of Ashland brought to the "Farming Special" an apple-tree branch on which were a number of Lecanium scales (*Eulecanium cerasifex*).

April 28. E. G. Childs of Belgrade sent egg-cluster of tussock moth.

April 30. W. E. Ingersoll, Columbia Falls, sent in an egg-cluster of the white-marked tussock moth (*Hemerocampa leucostigma*), and one of the old tussock (*Notolophus antiqua*).

April 30. From Mrs. A. V. Plummer, Gorham, a polyphemus cocoon.

May 2, F. D. Thurston, Norway, sent an egg-cluster of the apple tent caterpillar.

May 4. Received from C. E. Brasier of Guilford a nest and egg-cluster of the old tussock moth (*Notolophus antiqua*).

May 8. Received from Mrs. A. V. Plummer, Gorham, a cecropia cocoon and two egg-clusters of the apple tent caterpillar.

May 9. A nest of spider's eggs was sent by Mrs. E. W. Beal of Greene.

May 16. Miss Ethel Thorn, Island Falls, sent in a male water beetle (*Dytiscus dauricus*).

May 16. From Raymond Emerson of Island Falls, a female water beetle (*Acilius fraternus*).

May 19. E. D. Nutting, Hebron Station, sent in egg-clusters of the white-marked tussock moth.

May 21. A. E. Varney of Penobscot sent egg-cluster of white-marked tussock moth (*Hemerocampa leucostigma*).

May 21. From Geo. H. French, "Maine Farmer," Augusta, a specimen of manure beetle (*Aphodius granarius*).

June 3. J. W. Manson of Pittsfield sent specimens of the apple bud moth larvæ (*Tmetocera ocellana*).

June 4. Received from Mrs. A. V. Plummer of Gorham cocoon of the cecropia moth.

June 4. D. H. Knowlton of Farmington sent three cecropia moth cocoons.

June 4. From H. H. Adams, Belgrade, a cocoon of the cecropia moth (*Samia cecropia*).

June 5. Mrs. Annie J. Davis of East Poland sent box of red spiders (*Tetranychus telarius*).

June 18. H. J. Reynolds of Ridlonville sent a goldsmith beetle (*Cotalpa lanigera*).

June 18. Mrs. J. F. Trafton, Fort Fairfield, sent specimen of giant water-bug (*Belostoma americanum*).

June 19. Received from William Miller of Bar Harbor spruce buds infested with a species of tortricid moth.

June 20. A specimen of *Buprestis lauta* was sent in by Mrs. E. B. Dunbar, Waterville.

June 28. Dr. B. F. Sturgis, Auburn, sent larva of *Euvanessa antiopa.*

June 28. William Miller of Bar Harbor sent apple borer (*Saperda candida*) in mountain ash.

June 29. From S. L. Boardman, Bangor, maple-leaf gall.

June 30. G. S. Pain of Winslow sent in a specimen of cherry-tree ugly nest (*Archips cerasivorana*).

June 30. Received from W. P. Stewart of Waterville larvæ of the mourning cloak butterfly (*Euvanessa antiopa*).

July 2. Archer M. Clement sent a cherry-tree ugly-nest.

July 2. B. F. Fernald, Winn, sent in a luna moth (*Tropaea luna*).

July 2. From Mrs. J. F. Trafton of Fort Fairfield, a specimen of giant water-bug (*Belostoma americanum*).

July 2. A. L. Brann sent a specimen of the cherry-tree ugly nest.

July 3. A specimen of the butterfly *Euvanessa antiopa* was sent by C. W. Sedgley of Bowdoinham.

July 3. Geo. E. King of Lamoine sent in specimens of the oyster-shell bark-louse, *Lepidosaphes ulmi*.

July 3. Mr. V. Crockett, Dexter, sent a mourning cloak butterfly (*Euvanessa antiopa*).

July 3. From Geo. O. Eustis, East Livermore, a mourning cloak butterfly.

July 5. A specimen of cherry-tree ugly-nest was sent in by A. J. Abbott, West Paris.

July 6. A mourning cloak butterfly was received from R. E. Hersom of Lebanon.

July 6. W. S. Withers, Oakland, sent a specimen of the apple tent caterpillar.

July 10. Miss Maybelle Haines sent a sphinx moth (*Ceratomia amyntor*).

July 10. Received from R. D. Leavitt, Auburn, a specimen of the apple woolly aphis (*Schizoneura lanigera*).

July 10. A larva of the mourning cloak butterfly was sent by David Campbell of Cherryfield.

July 11. Prof. Roland Thaxter discovered a fungous disease (*Empusa aulicae*), destroying the brown-tail larvæ at Kittery.

July 11. From Mr. Anderson, City Forester, Westbrook, the mourning cloak butterfly.

July 11. D. E. White of Columbia sent a cherry-tree ugly-nest (*Archips cerasivorana*).

July 11. Mr. John A. Getchell, Insane Asylum, Augusta, sent in a specimen of the apple woolly aphis.

July 12. Larvæ of the mourning cloak butterfly were received from H. A. Farrington of Rockland.

July 12. A specimen of the apple tent caterpillar was sent by P. B. Gardiner, Machias.

July 12. E. E. Ham, North Shapleigh, sent larvæ of mourning cloak butterfly.

July 12. L. C. Bateman of Lewiston sent in larvæ of the mourning cloak butterfly (*Euvanessa antiopa*).

July 12. Earl Gott, West Penobscot, sent in a mourning-cloak butterfly.

July 12. Received from Mr. Ansel Farnham, Waterville, an eyed elater (*Alaus oculatus*).

July 12. Mr. Hersom of Oakland sent in two luna moths.

July 12. An eyed elater was sent in by Mrs. Sara M. Collins, Farmington.

July 15. From Ruel K. Wilson of Rangeley, an egg-cluster and larva of a geometrid moth (*Ennemos marginarius*), and larvæ of the old tussock moth.

July 16. A larva of the luna moth was brought in by Hon. A. W. Gilman, Foxcroft.

July 17. Larvæ and moults of the mourning-cloak butterfly were sent by E. W. Rounds of East Baldwin.

July 17. A polyphemus moth was received from Mrs. A. V. Plummer of Gorham.

July 20. E. E. Hardy of Farmington sent in larvæ of the hickory tiger moth (*Halisidota caryae*).

July 20. Three brown-tail moths were sent by Nathaniel Hobbs, North Berwick.

July 21. Received from Mrs. H. K. Morrell of Gardiner a female brown-tail moth.

July 24. Four male brown-tail moths were sent by Miss Linda Thompson, Chelsea.

July 24. D. H. Knowlton of Farmington sent a larva of a saw-fly.

July 27. A sphinx moth (*Smerinthus jamaicénsis*) was sent by Mrs. D. G. Davis, Danforth.

July 27. L. C. Bateman, Lewiston, sent larvæ and pupa of white-marked tussock moth and eggs of apple tent caterpillar.

July 27. Mrs. D. G. Davis of Danforth sent a specimen of the black swallow-tail butterfly (*Papilio polyxenes*).

July 27. Gorham N. Weymouth, Biddeford, sent in one male, three females and an egg-cluster of the brown-tail moth.

July 27. Two male and two female brown-tail moths were sent in by D. H. Hooper of Biddeford.

July 27. Received from Mrs. Frank Beane, Augusta, a Monarch butterfly (*Anosia plexippus*).

July 30. A. L. Reed of North East Harbor sent in the following: Larvæ of willow saw-fly (*Cimbex americana*); pupæ and imago of one of the coccinellidæ "Lady Birds" (*Idilia bipunctata*); yellow birch plant lice on which were feeding the above "Lady Birds."

July 31. Mrs. H. A. Lewis of Portland sent from Malceroc larvæ of the black swallow-tail butterfly, and eggs of silk worm (*Bombyx mori*).

Aug. 6. Earl Gott of West Penobscot sent in a mourning-cloak butterfly and a white-marked tussock moth.

Aug. 6. Miss Rena Hamlin of Sidney sent several larvæ of coccinellidæ which hatched into beetles (*Chelymorpha argus*).

Aug. 6. Mrs. A. V. Plummer, Gorham, sent Harvest-fly (*Cicada tibicen*) and larvæ of juniper saw-fly (*Nematus ericksonii*).

Aug. 6. A. L. Rideout, Intervale, sent in a specimen of mourning cloak butterfly (*Euvanessa antiopa*).

Aug. 8. Mary Deering of Auburn sent eighteen male brown-tail moths.

Aug. 8. Julia E. Dyer, South Addison, sent in a mourning-cloak butterfly.

Aug. 8. Received from Mrs. A. V. Plummer of Gorham larvæ of swallow-tail butterfly, and a red-humped caterpillar (*Schizura concinna*).

Aug. 8. Mrs. Geo. Dunn, Norway, sent yellow-necked caterpillar (*Datana ministra*).

Aug. 8. From Henry James of Winthrop, a specimen of the fall webworm (*Hyphantria cunea*).

Aug. 9. Received from Robert Bosworth of West Pembroke the following specimens: one cecropia moth, a mourning-cloak butterfly, a Great Spangled Fritillary butterfly (*Argynnis cybelle*), one *Diacrisia virginica,* the following beetles: *Monohammus scutellatus, Picerca tuberculata, Hydrocharis obtusatus,* a species of horn-tailed borer and a wood cricket.

Aug. 10. F. H. Morse of Waterford sent specimens of woolly aphis (*Schizoneura lanigera*).

Aug. 10. From Mrs. T. Arthur, Waterboro, a geometrid larva (*Cingilia catenaria*), which feeds on pine and sweet fern.

Aug. 13. William Cooper of Milo sent a red-humped caterpillar.

Aug. 13. A red-humped apple worm and a larva of the tiger swallow-tail butterfly (*Papilio glaucus turnus*), were received from Miss Ivie E. Webster, Vassalboro.

Aug. 13. B. F. W. Thorpe of Augusta sent a tussock moth caterpillar.

Aug. 13. From C. B. Pinkham of Belgrade, a red-humped apple worm.

Aug. 13. A red-humped apple worm was sent by J. W. Goodwin, Brooks.

Aug. 13. Specimens of gooseberry lice and clear-winged sphinx (*Hemaris diffinis*), were received from Miss Gladys Powell of Danforth.

Aug. 14. Specimens of the red-humped apple worm were sent by E. L. Fogg, Bingham.

Aug. 14. Charles Stanton of Winthrop sent in a red-humped apple worm.

Aug. 14. An io moth caterpillar (*Automeris io*) was sent in by H. F. Maxim, Locke's Mills.

Aug. 15. Received from G. H. Knowlton, Sangerville, a red-humped apple worm and a yellow-necked apple worm.

Aug. 16. Miss May V. Ricker, Charlotte, sent a specimen of the red-humped apple worm and a white-marked tussock caterpillar.

Aug. 16. A specimen of the old tussock caterpillar (*Notolophus antiqua*), was sent in by W. B. Maddocks, North Ellsworth.

Aug. 16. Robert Nickerson of Brooks sent an egg-cluster of tent caterpillar and a cicada or harvest fly (*Cicada tibicen*).

Aug. 16. From Dr. E. H. McCurdy of Bluehill, white-marked tussock caterpillars.

Aug. 17. A red-humped apple worm was received from L. C. Bateman, Lewiston.

Aug. 17. W. P. Shurtleff of South Livermore sent a red-humped apple worm.

Aug. 17. A female brown-tail moth with egg-cluster was sent in by Alex Doyle, Squirrel Island.

Aug. 17. From John D. Craig, Dixmonth, red-humped apple worm.

Aug. 17. A red-humped apple worm (*Schizura concinna*), was sent in by Miss Rena Hamlin, Sidney.

Aug. 18. Seth Bessey, Dexter, sent specimens of the red-humped and yellow-necked apple worms.

Aug. 18. Specimens of the fall web worm were received from Etta C. Robinson of Dexter.

Aug. 18. From Geo. Tilton, Sidney, some red-humped apple worms.

Aug. 18. L. B. Seymore, Kent's Hill, sent a red-humped apple worm.

Aug. 18. A red-humped apple worm was sent in by L. A. Stone, Augusta.

Aug. 21. Received from Nelson Rose of Dixfield, a yellow-necked apple worm, a cecropia moth, and an io emperor moth with cocoon.

Aug. 22. A red-humped apple worm, from F. Lawrence Embree, Glendon, by E. E. Ring.

Aug. 22. S. L. Hitchings of Waterville sent from Seal Cove a woolly-bear caterpillar, a female white-marked tussock moth and a sphinx larva.

Aug. 22. Received from F. H. Loring of Parkman a red-humped apple worm, a cocoon containing dipterous parasites, a caterpillar which feeds on the oak (*Catocala briscis*), and a specimen of the oyster-shell bark louse (*Lepidosaphes ulmi*).

Aug. 22. A pair of crane flies (*Tipula bella*) was sent in by I. N. Lapham, Gardiner.

Aug. 22. From the orchard of Geo. Fred Terry, Waterville, some red-humped apple worms.

Aug. 22. Dan Berry, Waterville, brought in some red-humped apple worms for identification.

Aug. 22. Frank Pease of Waterville sent in a red-humped apple worm.

Aug. 23. Received from Mrs. Jennie H. K. Morrell, Gardiner, a woolly bear caterpillar, two io moths and a nest of maggots.

Aug. 24. A red-humped apple worm and a tortricid larva were sent in by Joseph F. White, Waterville.

Aug. 28. Mr. Leverett Bradley of North East Harbor sent in twigs of fir infested with a gall that worked in the terminal buds.

Aug. 29. Mrs. V. P. DeCoster, Buckfield, sent in larva of the luna moth.

Aug. 29. Master I. Leavitt Newman, East Wilton, sent cocoon of the cecropia moth (*Samia cecropia*).

Aug. 30. Received from Mrs. V. P. Decoster, Buckfield, larva of the polyphemus moth.

Aug. 31. E. E. Hardy, Farmington, sent in the yellow-necked apple worm.

Aug. 31. Received from Mrs. L. B. Seymore of Kent's Hill larva of *Coccinellidæ* also beetle of same family; specimens of the following butterfles: *Anosia plexippus, Brenthis myrina, Cercyonis alope,* and the moth *Arctia caia.*

Sept. 1. Mrs. V. P. DeCoster of Buckfield sent the following insects: Two sphinx moth caterpillars, two cecropia caterpillars spinning their cocoons, two polyphemus larvæ, one *Papilio glaucus turnus* larva, one caterpillar of the dagger-moth (*Apatela dactylina*), which feeds on the alder.

Sept. 3. A sphinx larva was sent in by A. G. Groover, Wiscasset.

Sept. 6. A. Martin of Sabattus sent a brown-tail moth's egg-cluster with the caterpillars hatched.

Sept. 6. A. F. Huchens, York Village, sent a hickory gall.

Sept. 8. Received from Earl B. Gott of West Penobscot a hickory tiger caterpillar and an unknown cocoon.

Sept. 8. W. H. Keith of North Monmouth sent a red-humped apple worm.

Sept. 10. The following insects were received from Alvah L. Reed, North East Harbor: A yellow-necked apple worm (*Datana ministra*), a red-humped apple worm (*Schizura concinna*), saw-fly larvæ, red-humped apple worm parasitized by *Exorista chelonia,* and a nest of the fall web-worm.

Sept. 10. A cocoon of the lappet moth (*Tolype vellida*) was sent in by J. W. Penney of Belgrade.

Sept. 11. Received from R. H. Coombs, Belfast, the following insects: One red-humped apple worm, woolly-bear caterpillar (*Arctia*), a cluster of white-marked tussock's eggs, and specimens of the oyster-shell bark louse on apple.

Sept. 11. O. H. Leavitt of Manchester, N. H., sent larvæ of a fly that works in the sunflower stalk.

Sept. 12. Geometrid larvæ (*Ennomos magnarius*) which feed on apple were sent in by Mrs. Amos Putman of Houlton.

Sept. 12. Received from Capt. H. L. Spinney, Seguin Light, larvæ of *Papilio polyxenes*, woolly-bear caterpillars and hickory tiger caterpillars.

Sept. 12. A red-humped apple worm, a yellow-necked apple worm and a cocoon of the hickory tiger moth were received from H. E. Wood, West Penobscot.

Sept. 14. Miss Elsie Craven, Hartley Cottage, Biddeford Pool, sent larvæ of the following insects: Polyphemus moth (*Telea polyphemus*), red-humped apple worm (*Schizura concinna*), swallow-tail butterfly (*Papilio polyxenes*), and one of the slug caterpillars.

Sept. 14. Caterpillar and pupa of the tiger swallow-tail (*Papilio glaucus turnus*), were sent by Miss Venia White Abbott, Columbia.

Sept. 14. Maple horn-tail borer (*Tremex columba*) was sent in by S. W. Carr.

Sept. 17. S. L. Boardman of Bangor sent a specimen of the large water beetle (*Dytiscus dauricus*).

Sept. 18. Miss Venia White Abbott of Columbia sent a tiger swallow-tail butterfly.

Sept. 18. Received from Miss Emma Wilson of Wayne larvæ of two of the tiger moths (*Halisidota tessellaris*) and (*H. caryæ*), specimens of the woolly-bear and egg-clusters of the tent caterpillar (*Malacosoma americana*).

Sept. 18. Specimens of lice on potato vines were sent in by Millard H. Wiswell, East Machias.

Sept. 22. A specimen of the yellow-necked apple worm was sent in by Mrs. E. M. Strout, Empire.

Sept 22. From John G. Davis, Surry, a woolly-bear caterpillar.

Sept. 22. Received from Mrs. Verna B. Allen, Turner, the following insects: Red-humped apple worm, woolly-bear caterpillar and pupa.

Sept. 22. The red-humped apple worm (*Schizura concinna*) and parasitic pupæ cases of same were sent in by H. Beal, Anson. The parasites were *Exorista chelonia.*

Sept. 24. From F. L. Gordon of Garland, specimen of old tussock (*Notolophus antiqua*).

Sept. 24. J. G. Davis of Surry sent in a box of maia moths (*Hemileuca maia*).

Sept. 24. Received from Chas. R. Coombs, Belfast, specimens of the catocala moths (*Catocala relicta*) and (*Catocala concumbens*).

Sept. 25. L. P. Breadeen of Andover sent in empty pupæ cases of parasitized red-humped apple worms. The parasites were *Exorista chelonia.*

Sept. 29. Received specimens of tree-hoppers (*Enchenopa binotata*) with fresh egg-masses from Norway.

Oct. 1. An ash sphinx larva (*Sphinx chersis*) was sent by Enoch Keirstead, Fairfield Center.

Oct. 4. J. O. Johnson, Liberty, sent two cocoons of the cecropia moth (*Samia cecropia*).

Oct. 4. Two cocoons of the cecropia moth were received from D. H. Knowlton of Farmington.

Oct. 4. A cocoon of the cecropia moth was sent by C. L. P. Handy, Albion.

Oct. 4. John G. Davis of Surry sent specimens of the maia moth (*Hemileuca maia*).

Oct. 4. Received from H. W. Jewell of Farmington three dragon flies and two goldsmith beetles (*Cotalpa lanigera*).

Oct. 4. Miss Linda Thompson, Chelsea, sent caterpillars of the hickory tiger moth, larva of small saw-fly and larva of an unknown moth.

Oct. 9. A cecropia cocoon was sent in by Mrs. G. B. Dennison, Phillips.

Oct. 11. Two cecropia cocoons were received from Morrill F. Luce, Anson.

Oct. 12. Willard F. Overlock of Razorville sent in a cecropia cocoon.

Oct. 13. From E. L. White, Bowdoinham, a cecropia cocoon.

Oct. 16. Robert McCleary, West Farmington, sent in two cecropia cocoons.

Oct. 16. A cecropia cocoon and a white-marked tussock moth (*Hemerocampa leucostigma*) were received from Miss Rena P. Noyes, Wilton.

Oct. 20. A cecropia cocoon parasitized by dipterous larvæ (*Frontina frenchii*) was sent in by Miss Mildred Wilkins, Notch.

Oct. 20. Miss Ida M. Pierce of Lincolnville sent a cecropia cocoon and some caterpillars of *Datana intigerrima.*

Oct. 23. Capt. E. E. Philbrook, Portland, reported a small wild apple tree infested with woolly aphis (*Schizoneura lanigera*) on road from Arrowsic to Georgetown, in the town of Georgetown. The tree was destroyed.

Oct. 25. E. C. Moody, York Village, sent egg-cluster of a species of spider.

Oct. 25. Received from Mrs. H. A. Lewis, Portland, caterpillars of the "Eight Spotted Forester" (*Alypia octomaculata*).

Nov. 16. Egg-clusters of the forest tent moth (*Malacosoma disstria*) were sent by John G. Davis of Surry.

Nov. 19. From John G. Davis of Surry, a brown-tail moth's nest.

Nov. 19. Received from Miss Emma M. Davis, Crowley's Junction, Lewiston, a cecropia cocoon and a nest of the brown-tail moth (*Euproctis chrysorrhoea*).

Nov. 19. Two male moths were received from J. E. Gross, Orland.

Nov. 22. A cecropia cocoon was sent in by J. G. Davis, Surry.

Nov. 27. Arthur B. Briggs of Canton sent nest of spider's eggs.

Dec. 1. A cecropia cocoon and a polyphemus cocoon (*Telea polyphemus*) were sent in by A. L. Richards, New Gloucester.

Dec. 5. Received from H. W. Moody of Waldoboro a cecropia moth cocoon, a brown-tail moth's nest and an egg-cluster of the white-marked tussock moth.

Dec. 6. E. M. Sadler of Brunswick sent from Dorchester, Mass., three cocoons of a new Japanese moth (*Cnidocampa flavescens*) lately imported.

Dec. 6. F. S. Jackson, South Paris, sent a brown-tail nest.

Dec. 10. Capt. E. E. Philbrook, Portland, sent twenty-two egg-clusters of the gipsy moth (*Porthetria dispar*), collected for educational purposes.

Dec. 10. A cecropia cocoon was sent in by J. E. Ridlon, Bonny Eagle.

Dec. 12. A cecropia cocoon on pine was received from Thomas A. Johnston, South Paris.

Dec. 12. Three alder caterpillars (*Apatela dactylina*) which had been parasitized by *Rhogas intermedius,* were sent in by Ross L. Looke, Jonesboro.

Dec. 13. Frank Lowell, Farmingdale, sent a scale insect on orange tree (*Coccus hesperidum*).

Dec. 27. Hiram Kelly Morrell of Gardiner sent in a goldsmith beetle (*Cotalpa lanigera*) for identification.

Grange Interest in the Work.

At the beginning of the year it was thought advisable, on account of the liability of the spread of the brown-tail moth and the advent of the gipsy moth into uninfested sections of the state, to see what could be done to arouse an interest in entomological work among the granges throughout the state. A circular letter, together with instructions for collecting and preserving the different insects was sent to the secretary of each grange in the state, the object being to disseminate information so that the members could come to know the different stages in the life histories of many of our most destructive insects. In the circular letter it was recommended that each grange appoint a committee of three to have the work in charge; specimens to be brought

in and arranged for a permanent collection for future use. Information was given so that one could learn to recognize the beneficial from the injurious.

Premiums were offered by the State Grange and the three state fairs for collections of injurious insects exhibited by the different granges in the state. Quite a number of granges appointed their committees and did some work, but only a few made collections to exhibit. Bangor Grange took first at Bangor, second at Waterville and third at Lewiston. Chelsea Grange took first at State Grange, first at Lewiston and first at Waterville. Turner Grange took second at State Grange and second at Lewiston. These exhibits were very creditable to the granges making them, and it is strongly recommended that all subordinate granges in the State profit by the example set by the above named granges.

It would be well for each grange to devote one meeting in the spring or summer and one in the fall or winter to the subject of injurious insects. The department stands ready to impart any information along these lines that may be called for. Collections of moths and butterflies; all kinds of grasshoppers; leaf eating beetles; borers, like apple, maple, pine, etc.; snap beetles; all kinds of leaf eating caterpillars and cut worms, wire worms, etc., could be made without any danger of destroying any of the farmer's friends.

The following is a brief outline of the different orders of insect life, which is given here for the benefit of those who may wish to begin the study of Entomology in a general way.

The several orders are:—

1. Neuroptera (Nerve wing) dragon flies, etc. Beneficial.
2. Orthoptera (Straight wing) grasshoppers. Injurious.
3. Hemiptera (Half wing) bugs and plant lice. Injurious.
4. Coleoptera (Sheath wing) beetles ...
   - Injurious . Borers. Snap beetles, etc. "June bugs".
   - Beneficial Tiger beetles. "Lady bugs", etc. Scavengers.
5. Diptera (Two Wing) flies, mosquitos, etc.
   - Beneficial Scavengers. Syrphus flies, etc.
   - Injurious . Railroad worm. Mosquitos, etc.
6. Lepidoptera (Scaly wing) butterflies and moths. Injurious.
7. Hymenoptera (Membrane wing) bees, hornets, saw-flies, etc.
   - Beneficial, Honey bee, etc.
   - Injurious, Saw-fly, etc.

With the above outline a grange committee of three wide-awake members could collect and arrange an exhibit that would be of great benefit to the grange. Bulletins on injurious insects can be produced free of charge from the Agricultural Department at Washington, also from the Experiment Stations in many of the different states. By means of the above at least two programs a year could be arranged with very profitable results.

Reports From Grange Secretaries.

In the fall blanks were sent out to the Secretaries of the subordinate granges in the state asking for information in regard to the prevalence of some of our more common insects during the season of 1906.

From these reports I compile the following, as selected from returns sent in from each county: —

ANDROSCOGGIN COUNTY.

Danville Junction Grange, Auburn, reported by Annie M. Arris.

Tent caterpillars more numerous than usual; Colorado potato beetles usual number; rose chafers very abundant; codling moths about as usual; railroad worms very abundant in fall fruit; cabbage worms and currant worms very common; grasshoppers plentiful.

Stephens Mills Grange, Auburn, reported by Willard Carver.

Cut worms were quite plentiful, white grubs were so abundant that whole beds of strawberries were ruined.

Excelsior Grange, Poland, reported by Mrs. C. G. Russell.

Potato beetles abundant, also tent caterpillars; grasshoppers were more abundant than usual.

AROOSTOOK COUNTY.

Island Falls Grange, reported by Edna H. Leavitt.

Cut worms quite troublesome; potato beetles, cabbage worms, currant worms and horn flies plentiful.

Monticello Grange, reported by C. C. Melvin.

Potato beetles and cabbage worms were very numerous and were so hard to get rid of "Bug Death" had to be used twice. Horn flies were very plentiful.

New Sweden Grange, reported by C. A. Landfors.

The potato beetle showed an increase; cabbage worms, cut worms, codling moths and currant worms were about as usual, but not very troublesome.

CUMBERLAND COUNTY.

Lakeside Grange, Harrison, reported by J. Arthur Chadbourne.

Potato beetles, codling moths and cabbage worms were more troublesome than usual; grasshoppers more abundant; red-humped and yellow-necked apple-worms increasing each year; mosquitoes less than usual.

New Gloucester Grange, reported by Mrs. Mabel J. True.

Cut worms, tent caterpillars, and potato beetles were abundant; the codling moth was not as common as usual; mosquitoes many; railroad worms were abundant.

Maple Grove Grange, Sebago, reported by E. M. Douglass.

Potato beetles plentiful; currant worms, cabbage worms and railroad worms very abundant; mosquitoes very few.

FRANKLIN COUNTY.

Webb River Grange, Carthage, reported by E. H. Staples.

Tent caterpillars and potato beetles abundant; codling moths and railroad worms scarce; grasshoppers and mosquitoes plentiful.

Framington Grange, reported by Clarence McCully.

Railroad worms very plentiful; red-humped and yellow-necked apple-worms more abundant than usual.

Aurora Grange, Strong, reported by Dana W. Sweet.

Tent caterpillars about the same as usual; striped cucumber beetles not as many as usual; potato beetles, rose chafers, flea beetles and codling moths very plentiful; cabbage worms, currant worms and railroad worms not many; horn flies abundant; mosquitoes many.

HANCOCK COUNTY.

Brookline Grange, reported by Rodney L. Allen.

Cut worms were plentiful; potato beetles many and increasing; codling moths few; mosquitoes many.

Alamoosook Grange, Orland, reported by J. E. Gross.

Cut worms, tent caterpillars, potato beetles, grasshoppers and mosquitoes were plentiful.

KENNEBEC COUNTY.

Capital Grange, Augusta, reported by G. A. Yeaton.

Cut worms, tent caterpillars, potato beetles, codling moths, railroad worms, grasshoppers, red-humped apple-worms and mosquitoes abundant.

Pittston Grange, reported by Mrs. Mary J. Ripley.

Cut worms, railroad worms and grasshoppers were abundant; potato beetles, cabbage worms and mosquitoes very abundant.

Readfield Grange, reported by W. G. Linton.

Cut worms, potato beetles, codling moths, railroad worms, grasshoppers and mosquitoes abundant.

KNOX COUNTY.

Georges Valley Grange, Appleton, reported by J. F. Taylor.

Cut worms very plentiful; tent caterpillars, potato beetles numerous; the railroad worm is the worst pest we have; yellow-necked apple worms and mosquitoes numerous.

Seven Tree Grange, Union, reported by E. L. Daggett.

Tent caterpillars, potato beetles, railroad worms, grasshoppers, red-humped and yellow-necked apple worms and mosquitoes abundant; codling moth more than for years. I find more brown-tail moth nests than ever before.

Highland Grange, Warren, reported by A. T. Starrett.

White grubs, potato beetles, railroad worms, grasshoppers, red-humped apple worms and mosquitoes were abundant; tent caterpillars many but decreasing.

LINCOLN COUNTY.

Seaside Grange, Bristol, reported by E. J. Ervine.

Tent caterpillars, cucumber beetles, currant worms, fall web worms, potato beetles, railroad worms and mosquitoes were abundant; cut worms, codling moths and onion flies few.

Eastern River Grange, Dresden, reported by G. S. Bailey.

Cut worms, tent caterpillars, potato beetles, black squash bugs, railroad worms, onion flies, currant worms and codling moths

plentiful; grasshoppers few; red-humped and yellow-necked apple worms plentiful; mosquitoes abundant.

Nobleboro Grange, reported by J. A. Perkins.

Tent caterpillars, cucumber beetles, potato beetles, railroad worms, mosquitoes and grasshoppers numerous; cut worms and cabbage worms many.

OXFORD COUNTY.

Mt. Cutler Grange, Hiram, reported by Albert G. Stearns.

Cut worms, tent caterpillars, potato beetles, rose chafers, black squash bugs, currant worms, railroad worms, grasshoppers and mosquitoes abundant; white grub very abundant.

Oxford Grange, reported by Bertie M. Phillips.

Cut worms, white grubs, potato beetles, cabbage worms, white-marked tussock caterpillars, grasshoppers and mosquitoes were abundant; tent caterpillars, striped cucumber beetles, currant worms, red-humped apple worms and fall web-worms few.

Lone Mountain Grange, Andover, reported by B. A. Cushman.

Tent caterpillars, white grubs, potato beetles, codling moths, currant worms, railroad worms and mosquitoes abundant; cut worms and red-humped apple worms few.

PENOBSCOT COUNTY.

Dexter Grange, reported by A. A. Eastman.

Cut worms, tent caterpillars, rose chafers, codling moths, railroad worms, onion flies, red-humped and yellow-necked apple worms on the increase; potato beetles, currant worms, horn flies and mosquitoes abundant.

North Newport Grange, Newport, reported by B. A. Patten.

White grubs, potato beetles, railroad worms, horn flies and grasshoppers were abundant; tent caterpillars, striped cucumber beetles, codling moths and currant worms few.

Orono Grange, reported by Miss Edith M. Patch by request of the grange.

Apple bud moths, tent caterpillars, striped cucumber beetles, potato beetles, flea beetles, fall web worms and spiny elm leaf caterpillars abundant; white grubs, codling moths, railroad worms, red-humped and yellow-necked apple worms and white-marked tussocks some; rose chafers scarce.

PISCATAQUIS COUNTY.

Resolute Grange, Brownville, reported by Mrs. Ellen B. Prescott.

Tent caterpillars and grasshoppers were few; potato beetles, rose chafers, currant worms, railroad worms and horn flies abundant. Fameuse apples destroyed by the apple scab.

South Dover Grange, reported by Mrs. B. S. Ayer.

Cut worms, tent caterpillars, white grubs, grasshoppers, red-humped and yellow-necked apple worms, fall web worms, spiny elm leaf caterpillars and mosquitoes scarce; potato beetles, cabbage worms and currant worms abundant.

Juanita Grange, Monson, reported by Mrs. Geanie M. Sherburne.

Cut worms, tent caterpillars, white grubs, potato beetles, cabbage worms, railroad worms and mosquitoes abundant; grasshoppers, red-humped and yellow-necked apple worms, white marked tussocks, fall web worms and spiny elm leaf caterpillars scarce.

SAGADAHOC COUNTY.

Sagadahoc Grange, Bowdoin, reported by Mary E. Cornish.

Apple bud moths, tent caterpillars, rose chafers, black squash bugs, horn flies and fall web worms were scarce; cut worms, white grubs, cabbage worms, currant worms, railroad worms, red-humped apple worms many.

Dromore Grange, Phippsburg, reported by J. F. Upton.

Cut worms, tent caterpillars, striped cucumber beetles, potato beetles, cabbage worms, currant worms, horn flies, plant lice and mosquitoes were abundant; railroad worms, some; fall web worms and grasshoppers few.

Enterprise Grange, Richmond, reported by E. W. Libby.

Apple bud moths, black squash bugs, railroad worms, onion flies, plant lice, red-humped and yellow-necked apple worms and spiny elm leaf caterpillars scarce; cut worms, tent caterpillars, white grubs, striped cucumber beetles, potato beetles, flea beetles, cabbage worms, currant worms, horn flies, grasshoppers and mosquitoes were abundant.

SOMERSET COUNTY.

Brighton Grange, reported by E. A. Decker.

Striped cucumber beetles, potato beetles, cabbage worms, currant worms, horn flies and yellow-necked apple worms were abundant; tent caterpillars, white grubs and grasshoppers few.

Victor Grange, Fairfield, reported by Henry T. Choat.

Apple bud moths, cut worms, cucumber beetles and yellow-necked apple worms few; tent caterpillars, potato beetles, codling moths, cabbage worms, currant worms, railroad worms, horn flies, red-humped apple worms, mosquitoes and grasshoppers abundant.

Pittsfield Grange, reported by Edith W. Phinney.

Cut worms, white grubs and black squash bugs few; apple bud moths, tent caterpillars, striped cucumber beetles, flea beetles, rose chafers, potato beetles, codling moths, cabbage worms, currant worms, railroad worms, horn flies, plant lice, red-humped and yellow-necked apple worms, mosquitoes and grasshoppers abundant.

WALDO COUNTY.

Sheepscot Lake Grange, Palermo, reported by Mrs. Violet Lenfest.

Cut worms, tent caterpillars abundant; red-humped and yellow-necked apple worms, fall web worms and grasshoppers few; potato beetles, rose chafers, codling moths, cabbage worms, currant worms, railroad worms, horn flies and mosquitoes abundant.

Granite Grange, Searsport, reported by E. Winifred Mathews.

Tent caterpillars, white grubs, striped cucumber beetles, potato beetles, cabbage worms, railroad worms, onion flies and mosquitoes many; apple bud moths, cut worms, black squash bugs, currant worms and plant lice few.

Frederick Ritchie Grange, Waldo, reported by C. A. Levanseller.

Apple bud moths, potato beetles, railroad worms, horn flies, mosquitoes and grasshoppers abundant; tent caterpillars, flea beetles and cabbage worms few; cut worms scarce.

WASHINGTON COUNTY.

Charlotte Grange, reported by Miss Nellie E. Fisher.

Apple bud moths, cut worms, tent caterpillars, white grubs, potato beetles, flea beetles, cabbage worms, currant worms, railroad worms, horn flies, mosquitoes, grasshoppers, red-humped and yellow-necked apple worms, fall web worms and spiny elm leaf caterpillars abundant; striped cucumber beetles, rose chafers, black squash bugs, codling moths, onion flies, plant lice and white-marked tussocks scarce.

Columbia Grange, reported by Harrison Smith.

Cut worms, tent caterpillars, white grubs, striped cucumber beetles, black squash bugs, cabbage worms, horn flies, mosquitoes and grasshoppers abundant.

Princeton Grange, reported by Ervin R. Sprague.

Apple bud moths, cut worms and grasshoppers few; tent caterpillars, potato beetles, cabbage worms, currant worms, horn flies and mosquitoes abundant.

YORK COUNTY.

Buxton Grange, reported by Chas. A. Moulton.

Tent caterpillars few; white grubs, rose chafers, cucumber beetles, cabbage worms, potato beetles, railroad worms, grasshoppers, plant lice, onion flies and red-humped apple worms some.

Maplewood Grange, Parsonsville, reported by Luther E. Sanborn.

Apple bud moths, potato beetles, rose chafers, flea beetles, codling moths, cabbage worms, railroad worms and fall web worms abundant; black squash bugs, cut worms, tent caterpillars, cucumber beetles, grasshoppers and mourning cloak butterflies few.

Wells Grange, reported by Chas. F. Spiller.

Cut worms, white grubs, cucumber beetles, potato beetles, rose chafers, cabbage worms, currant worms and grasshoppers abundant; tent caterpillars and onion flies few.

Respectfully submitted,

E. F. HITCHINGS,

State Entomologist.

EXTRACTS FROM CATTLE COMMISSIONERS' REPORT.

We herewith submit the report of the Cattle Commissioners for the two years commencing Dec. 1904 and ending Dec. 1, 1906, containing our accounts of cattle, horses and sheep condemned and destroyed under the provisions of the law of 1887, chapter 19, relating to contagious diseases among cattle, horses and sheep, and as amended in 1898, and also the new law, passed by the Legislature in 1905, relating to pure blood cattle.

During the two years there have been condemned and destroyed by your commission as follows:

	Cattle.	Horses.	Totals.	Sheep
1905	626	81	707	
1906	970	47	1,017	381
Totals	1,596	128	1,724	381

AVERAGE COST FOR THE YEAR 1905.

Cattle and horses including all expenses, $35.25; condemning and destroying, including all expenses, $12.07; owner received per animal, $23.18.

AVERAGE COST FOR THE YEAR 1906.

Cattle and horses, including all expenses, $35.77; condemning and destroying, including all expenses, $12.17; owner received per animal, $23.60; amount of business done during the two years, paid for, $32,488.02; amount of business done during the two years, not paid for, $28,814.77.

Total amount of business done during the two years, $61,302.79.

List of items for the deficiency of 1904 can be found in the 1904 report.

During the years 1903 and 1904 the cattle cost the state an average of $33.98, including all expenses. It cost an average to condemn and destroy, including all expenses, $11.91; the owners received an average of $22.07.

During the years of 1905 and 1906, under the same conditions, cattle cost $35.48 each. It cost to condemn and destroy, including all expenses of testing 935 pure blood cattle under the new law and all other expenses pertaining to the business, an average of $12.14; the owners received upon an average, for each animal, $23.34.

More work has been done by the commissioners and more money expended during the last two years than any other two years within the history of the board. And it is the duty of the commissioners to show why more work has been done and more money expended.

The custom previous to 1904 in relation to pure blood cattle being brought into the state for breeding purposes, was for the commissioners to grant permits upon the tests made by the veterinarians in the state where the cattle were bought. The commissioners discovered by destroying several large herds that the disease was traced back to some animal that had been brought in from another state, and used in the herd for breeding purposes; sometimes it would be a male and sometimes a female. This condition of things was reported by the commissioners to the agricultural committee two years ago, and they thought advisable to pass a law whereby all pure blood cattle brought into Maine from another state should be tested by order of the Maine commissioners within thirty days after arrival, and also all pure blood cattle sold within the state should be tested before delivery.

The commissioners had no way of knowing what the expense of this new law would be, but the legislature appropriated about three thousand dollars more than the commissioners expended in the two years previous, which brought the appropriation up to thirty thousand dollars, for the two succeeding years, 1905 and 1906. The first year the law was in force we condemned twenty-three cattle and the last year, seven, that were brought into the state for breeding purposes. These cattle were destroyed with-

out an appraisal, being a total loss to the owners, on account of the law prohibiting an appraisal upon any animal until it had been owned in the state three years. The record shows that this law has put a check upon diseased animals being shipped into the state for breeding purposes, and in the opinion of the commissioners has made a decided improvement in this line.

The records show that before the new law was passed, the commissioners' work was confined practically to grade herds where only about six per cent were found diseased, practically leaving the pure blood herds uninvestigated, where twenty per cent. have been found diseased by enforcing the new law. Now it would not be fair to claim that the new law is responsible for the total number of one hundred and ninety cattle condemned since its enactment, because there probably would have been some found had it not been for the new law, just how many we cannot tell, but it would be a fair estimate to claim that it has caused the condemning of at least one hundred and thirty that we would not have had to pay for had there been no new law. These cattle cost the state nearly fifty dollars each, which will account for sixty-five hundred dollars ($6500.00) and the estimated extra expense will be at least thirty-five hundred dollars ($3500.00) making a total of ten thousand dollars ($10,000.00) and this will account for so much of the extra amount expended by the commissioners this last year.

The second section of the new law has brought us in contact with nearly all of the pure blood herds in the state. This provided that all pure blood cattle shall be tested when a sale is made, before delivery. When the law was first put into operation we would send out veterinarians to test just the animal that had been sold and often would be obliged to send veterinarians to the same herd once and often twice in the same month. This we found to be very expensive and we commenced to explain to the owners of the herd whenever they applied to have one or two tested, that we could test the whole herd for nearly the same expense that we could test one for, and advised them to have their whole herd tested, as it would be far less trouble to them, as we could guarantee to them that they could sell at any time up to the time limit of the law, by simply sending to us the certificate of the sale. This rule worked satisfactorily to both the commissioners and the owners and has caused the testing of nine

hundred and thirty-five pure blood cattle, out of which one hundred and sixty have been found diseased and destroyed out of one hundred and thirty-six Maine herds, and thirty out of foreign herds. Total, one hundred and ninety.

About March first of this year the Portland Board of Health called the attention of the commissioners to the health of the herds then supplying Portland with milk and cream. They complained somewhat, by saying they did not think the herds supplying Portland with milk had received the attention they should have received within the last few years. They were told by the commissioners that Portland had been treated the same as all the other sections of the State. They always answered to all applications made and took care of all animals found diseased, but had never used arbitrary methods and had never ordered the testing of any herds furnishing milk to Portland or any other city in the State, and that the appropriation made by the last legislature was entirely exhausted and it would be a hardship to the farmers, if any amount of cattle were found to be diseased, to wait until the next legislative meeting for their pay. The Board seemed to be fair in the matter, yet they were persistent and claimed that they had good reasons to believe that there was more or less milk sold that was produced from tuberculous cows. And in order to justify their claim we take the liberty to publish that part of their 1906 report relating to the Bureau of Milk Inspection.

"It is well recognized that milk is a universal article of food, the chief and most necessary and most perfect food for children. It is often the dirtiest of foods, and when it comes from diseased animals, contaminated by barnyard filth and street dust, and distributed in unclean cans or bottles, no process of filtration, pasteurization or sterilization can possibly make it a fit food for infants or sick persons. There is no sanitary problem of greater magnitude than the proper control and improvements of the production and sale of milk.

"In January, 1906, the Board of Health took entire charge of the Bureau of Milk Inspection and elected Edgar F. Sweet milk inspector.

"The work of this department had not been very satisfactory. It was found that there was no system in use which would adequately show the work of this department, or by which the pro-

gress made in improving the milk supply could be demonstrated. A new system was inaugurated, the milk inspector's office was equipped with apparatus approved by the State Dairy Inspector, and all of the tubes and testing apparatus duly inspected by the State experts and put in first-class condition.

"On making a careful analysis of the situation the Board decided to begin its work in attempting to improve the milk sold in this city by getting at the source of supply and making a thorough inspection of all cows and dairies. As a preliminary step the Board secured the consent of the owners of three herds of cattle in the vicinity of Portland and had these cattle tested with tuberculin applied by a veterinarian recommended by the Board of Cattle Commissioners.

"There were twenty-seven cows in these three herds, and of this number five were reported diseased. On being killed these animals were found to be badly affected with tuberculosis. The situation seemed to warrant a further investigation, and with the consent of the owners, the Board continued testing cows for tuberculosis. The percentage of diseased cows rapidly increased as the work went on, until it reached sixteen and a half per cent. The Board then decided to require all dealers in milk to show a clean bill of health for their animals before they were given a license or allowed to continue the sale of milk in Portland. The following notice was ordered sent to all milk dealers in Portland:

" 'Notice is hereby given to the dealers in milk in the city of Portland that the Board of Health of said city requires (in compliance with the rules and regulations relating to the sale of milk within the city of Portland, Maine, approved by Thomas H. Haskell, Associate Justice of the Supreme Judicial Court, June 29, 1897), that all milk and cream sold or offered for sale within the city limits on and after June 10 A. D. 1906, shall come from cows which have been examined by the tuberculin test for tuberculosis, applied by some veterinarian, approved by said Board, and a certificate of such examination, giving the name and residence of the owner or keeper of the cow or cows, and a description sufficient for identification, and the place and conditions as to the food and drink furnished such cow, and showing that such cow is healthy and free from disease, shall have been filed with the Secretary of the Board.

" 'And notice is further given that the license of all milk dealers in the city of Portland having expired by limitation on the first day of May, A. D. 1906, no license will be recommended by said Board of Health to any dealer in milk in said city who has not complied with the above regulations.

" 'Attention is called to the provisions of the by-laws of the Board of Health relating to the sale of milk which provides that any violation of said by-laws by any person or corporation shall be deemed a misdemeanor, and upon conviction thereof such person or corporation shall be punished by a fine of not more than fifty dollars.

" 'Attention is further called to Section 4 of the "Ordinance Relating to Milk," which provides that any man who has in his possession milk intended for sale, and who attempts to sell this milk without having been licensed to do so, shall for the first offense be punished by a fine not exceeding twenty dollars and for a subsequent offense, by a fine not exceeding fifty dollars.

" 'On June tenth, those milk dealers who have complied with the requirements of the Board of Health will be recommended for a license and granted a clean bill of health, and until that date no certificate of health, in addition to those already issued, will be issued any milk dealer in the city.

CHARLES M. LEIGHTON, M. D.,
WALTER E. TOBIE, M. D.,
HARRY M. BIGELOW,

Board of Health.' "

The report shows the authority vested in the Board of Health, not only of the city of Portland, but all other municipalities of the State, and it would make no difference with their law or their duties whether there was a cattle commission or not, or whether the State appropriated money to pay for animals found to be diseased or not. They have a right by law to demand that all food products shall be above suspicion as far as healthfulness and purity are concerned.

Portland is the largest city in the State, claiming nearly sixty thousand population, and it requires at least six thousand cows to supply the market with milk and cream, supplied principally from three counties, namely, Cumberland, York and Oxford; a

small amount comes in from New Hampshire over the Boston & Maine Railroad, and quite a good cream supply from the Solon Creamery, Somerset county. There was no general complaint made by the farmers against the test. They did complain, however, that they had to wait so long for their pay and on account of the extra expense of paying for testing the healthy animals, claiming that they did not receive enough for their milk and cream to justify it. The commissioners were satisfied of the fact and set themselves to work among the dealers and producers to raise the price, and succeeded in raising the price of milk one cent per quart and butter fat two cents per pound. It requires at least twenty thousand quarts of milk per day to supply the market, which would make two hundred dollars per day more to the farmers and seventy-three thousand dollars per year. Now this is a large sum of money for the consumers to pay for the purpose of having pure and healthful milk, yet we have no complaint and good feeling seems to prevail among the dealers, consumers and producers. The records show that five thousand one hundred and thirty cows have been tested for the Portland milk and cream supply, and up to date there have been three hundred and ten cows condemned and destroyed, or about six per cent, costing the State approximately seven thousand and seven hundred dollars, making the total expense for the investigation very nearly ten thousand two hundred dollars. Now when we take into account the seventy-three thousand dollars per year rise on the products, it does not seem to be a very bad investment.

Then, again, it is a good advertisement for our Maine dairy producers. In the early spring Mr. Keating, the British consul, was making inquiry in regard to the healthfulness of our Maine dairy herds and remarked to one of the members of the Board of Health that it would be very gratifying to him to be able to report to his government that Maine was making every effort to keep her dairy herds free from tuberculosis, and her dairy products were yet free from suspicion.

Your commissioners have received from the Bureau of Animal Industry at Washington twenty-seven hundred doses of tuberculin free, on condition that a duplicate test shall be sent back to the department in order that our government may know what action Maine is taking in suppressing tuberculosis, and we

indirectly understand that the work that has been done at Portland is very satisfactory to the Bureau of Animal Industry at Washington and this will have an influence in holding, if not raising, the reputation of Maine dairy products. We should always bear in mind that a good price for a good article is far more profitable than a low price for a poor article.

Tuberculous cattle are not all sick, and it should not be understood that way, and there is no doubt that a certain per cent will apparently recover. This fact was practically demonstrated by our work the last year. There were thirty fine and healthy looking cows out of several different herds that showed a characteristic reaction in the spring that were quarantined and dried off and turned to pasture and after running out in the open air two or three months were all taken up and retested by different veterinarians, and out of the thirty, five stood the test and were released. They are all on record and all under the observation of the commissioners and will be closely watched and will be retested some time in the future in order to carry out the experiment.

We hear it said occasionally that the commissioners are not getting ahead in the work and that tuberculosis is increasing instead of growing less. It seemed that way to the commissioners until within the last year, and we wish to call attention to a few facts we have on record. We will take the Solon Creamery section for an example. Within the last few years the commissioners have had considerable trouble in Somerset county, especially around Solon, Embden, Bingham and North Anson, and have destroyed several large herds, and when the commissioners were notified that the patrons of the Solon Creamery were to test their herds, we felt fearful that there would be a large per cent diseased, but after the work was finished it was very gratifying to the commissioners to learn that, out of over eight hundred cows tested, only two and one-half per cent were found diseased. And still another section where the commissioners have been doing a large amount of work within the last few years, is located in Oxford county, in the vicinity of the Oxford Creamery at South Paris. By the work that has been done in the past it would seem to be a badly infected section, and yet out of eight hundred cows tested only twenty-six were found to be diseased, or about three per cent. So these two cases and others we might

mention seem to be fairly good evidence that wherever we have worked we have made the disease much less. There are sections where there is practically no disease. There were three hundred cows tested around Bryant's Pond and only five found diseased, and in nearly all of the northern towns where farmers raise their cows, tuberculosis is almost an unknown disease, but in the southern part of the State and along the railroads, in the pure blood section and around the cities and trading centers where cows are kept for milk supply, where they are kept closer and fed higher, in those sections we have yet more work to do; and yet we notice a decided improvement along the line of better ventilation and more exercise, and that the farmers are taking more interest and looking after their herds as far as healthfulness is concerned. Many have an idea that the commissioners believe that the tuberculin test is infallible. This is a wrong impression. We do not, yet it is the best thing to diagnose a case and is used in all countries where tuberculosis exists. Out of the three hundred and ten cattle destroyed at the Portland investigation there were twelve that showed no sign of tuberculosis with the naked eye on the post mortem examination, yet this could not be called a scientific post mortem. Possibly by going farther with a microscope tuberculosis might have been found in nearly all of these cases, yet we record it as four per cent not showing any traces of tuberculosis. Then, upon the other hand, there were five that did not respond to the test. These cows were wrecks and condemned upon a physical examination, and were all found to be very bad cases. And every one who has his herd tested must expect occasionally to find this condition of things, but the per cent is very small.

Does the tuberculin test injure the animal? The opinion exists among some farmers who have never had any experience with tuberculosis, that the test injures all animals injected. This is entirely wrong. It should be understood that tuberculin has no effect except upon tuberculous animals; for instance, if an animal is injected with tuberculin and after twelve or fourteen hours her temperature rises from three to five degrees, then the animal is affected by the test, but if the temperature does not rise, then it has no effect whatever and the animal stands as sound and healthy in every respect as before injection. It is a settled question by the best authority that the test does not injure

sound animals. And the most important question for the Maine dairymen to consider is, whether they will continue to destroy animals by the tuberculin test whenever it is practical, or whether they will condemn in the future only by physical examination. While it seems hard to destroy an animal that has no physical signs of tuberculosis, yet it is a fact, if the same animal is allowed to remain in the herd until she shows the disease sufficiently to make out a case, the chances are ten to one that she has communicated it to the other animals in the herd, and in almost every instance this is the way whole herds become tuberculous. Now with the small amount we have in the state as compared with other states, the least of any in the New England states, can the dairymen of Maine afford to allow tuberculosis to increase in their herds by ceasing to destroy animals that react by the tuberculin test?

The disinfecting of premises is an important factor in our work and requires quite an expense and quite a portion of the commissioners' time in looking after it. It is our intention to have every crib and stall wherever a diseased animal has stood disinfected. We gauge the expense generally by the condition of the animal; for instance, if an animal is found to be only slightly affected not as much is done as when the animal is found to be badly diseased. The expense causes us to use our judgment as to how much shall be done to be safe. There are cases where fifteen to twenty-five dollars have been expended on a single stable. Generally we divide the expense by agreeing for the owner to do the work and the State pay for the disinfectants. We are expending more money and giving more attention to this part of the work than formerly.

Number of cattle tested in Portland investigation, 5,130; number condemned, 310; per cent diseased, 6 of the number tested.

1905 and 1906—Number of pure blood cattle tested, 935; number condemned, 160; number condemned in foreign herds, 30; per cent diseased, 20 of the number tested.

Extra expense incurred by new law, $10,000.00; cost of Portland investigation, $10,200.00.

HOG CHOLERA.

In the latter part of 1905 it was reported that quite a large number of hogs and pigs were dying in and around the city of Waterville. At first the commissioners thought, as the law did not provide for an appraisal upon hogs, that we had no jurisdiction over the matter. The disease first broke out upon the farm of Mr. G. F. Terry and he called Dr. A. Joly of Waterville to diagnose and treat the case. Dr. Joly thought the disease might be cholera and in order to make certain he sent some of the fecal matter and some of the blood to Mr. H. F. Quinn, the State Bacteriologist, who found the bacilli of hog cholera. At this time Mr. Terry called upon the Commissioners and insisted that they ought to do something in the matter, as it was a contagious disease and spreading rapidly and causing a heavy loss upon the farmers in that vicinity. Under these circumstances we felt it our duty under the law to do what we could to stop the spreading of the disease, if possible, and suggested to Dr. Joly that he confer with the Bureau of Animal Industry at Washington in order to get what information he could upon the matter. He did so and we submit his report upon the results obtained:

"*Hon. Cattle Commissioners of the State of Maine*:

Gentlemen: I hereby submit my report of the investigation and work done, during an outbreak of hog cholera, which prevailed in Kennebec and Somerset counties. I was called to G. F. Terry's farm on January 4th, 1906, and was told that the disease appeared sometime in November, 1905, and that about 40 hogs had died. By the symptoms found and history of the disease related, I had reason to believe and suspect hog cholera, so one hog was killed on the premises that day, and post mortem showed ulcers of the bowels, extravasation of blood into the tissues, the spleen enlarged and ulcers present. Some of the fecal matter and some of the blood were sent to the State Bacteriologist, H. F. Quinn, who succeeded in isolating the bacillus of hog cholera.

The Bureau of Animal Industry was asked for instructions. What could be done? Could any serum be used with benefit? Dr. Melvin answered that the Bureau had no serum to recommend and did not believe it to be a practical form of treatment

for general use. During this time twenty more pigs died at Terry's farm and two other herds became infected in the neighborhood. After consulting with your board, you authorized me to use the serum treatment and make the necessary investigation and stamp out the outbreak if possible. I sent for a supply of Dr. Vaux's cholera anti-toxin and at the same time I investigated cases which were reported to me. Charles Fuller, North Fairfield, lost one pig bought at Terry's farm, in December, 1905; A. B. Jenkins of Fairfield Centre lost four, also bought at Terry's farm in December, 1905. Silas Small lost 4, Wm. Hersom lost 3, Fred Pullen lost 2, Maurice McNally lost 7, and Oscar Carroll 12; no connection with Terry's farm could be detected. January 26th, 1906, I began the serum treatment, which requires four injections, one injection on 1st, 2nd, 5th and 21st day. Thirteen head were treated at Terry's farm; all recovered. It might be suggested that the remaining 13 were immune, to which suggestion I will answer that 7 head of those 13 showed temperature over 104, which proved that the disease existed at that time, and furthermore the same day before the inoculation one dead pig was found.

At Oscar Carroll's, who lost 12 head, 9 were bought and placed in the same infected stable. They were inoculated, and all escaped the disease. Fifteen head were treated at P. Rheaume's, where six of them appeared very sick, but only one died.

No other cases have been reported, and I believe the outbreak to be stamped out, and I believe the serum treatment to be a rational one and practical.

In reading the report of the Bureau of Animal Industry one can see that many outbreaks of supposed hog cholera had been successfully treated with cholera anti-toxin; but the Bureau claimed that the diagnosis of the disease was doubtful and it was not advisable to give too much credit to the serum treatment.

There can be no question in the diagnosis of this present outbreak, as the bacteriological findings have proved to be true.

Respectfully submitted,

A. JOLY, D. V. S."

GLANDERS.

We note no increase in glanders this last two years; 128 horses were destroyed during 1905 and 1906, and 128 during the years of 1903 and 1904. The disease seems to prevail mostly among team horses in the eastern part of the State. It is very necessary that every precaution be taken to guard against the spreading of this most insidious disease and in cities or wherever public watering troughs are located it should be the duty of some one to see to it that the troughs are cleaned out and thoroughly scrubbed at least once a week, and veterinarians should be prompt in reporting suspicious cases.

TUBERCULOSIS IN SHEEP.

Tuberculosis among sheep is a very rare disease and within the last ten years we have had but very little trouble in this line. It appears in the Maine Cattle Commissioners' Report for 1896, that trouble was reported with a flock of sheep in the town of Belfast; three of the sheep were killed and their lungs were sent to Dr. Charles D. Smith, who was at that time pathological examiner for the Board. And his report was, "I find masses from the size of a split pea to a marble, which upon examination proved to be tubercular." Since that time we have had no trouble with sheep until this last year, when one case was reported in the town of Belfast and two in the town of Dexter. The two Dexter flocks contained some 350 sheep and lambs and a large proportion of these were pure blooded and very valuable. At the time they were reported to the Board the disease had advanced to such a stage that they were dying off very fast and after a careful examination it was decided by good authority that the trouble was tuberculosis and the entire flocks were destroyed. We were unable to give the cause of the disease in these two flocks. They were all in one neighborhood and the farms upon which they were owned joined, and as we have had no more trouble we are led to believe that there is no more disease in that section.

There is no question but that the disease was *first brought into Maine by buying it in some way.* Now the pure blood buyers are protected by law, but the grade buyers as yet have no protection and during the Portland investigation the farmers

were continually asking the question, "How can we keep clean after we have cleaned up our herds, when we are obliged to buy others to replenish?"

This is an important question for consideration. It is a fact that where milk producers lose cows that are diseased and go out to buy they are liable to buy diseased cows unconsciously, not being able to detect any symptoms of disease at the time of buying, and possibly in infected sections they have bought a diseased cow, which they would not have bought had they known that the cow would not have stood the tuberculin test. This seemed to be the only complaint made by the farmers against the test in the Portland investigation. There is not a farmer in the State of Maine that wants a tubercular cow in his herd. Yet under the present law he has no protection; he can say to the seller in making the trade, "If you will warrant this cow to stand the tuberculin test I will buy her." This generally ends the trade, for only occasionally will the seller agree to such a proposition. Hence the buyer has to take his chances, and the chances are in some sections of the State that he has bought a tuberculous cow. Now there are two ways to get out of this difficulty; one is for the buyer after he has had his herd cleaned up, to have all animals bought tested; the other is to have a general test by the State, and this would require a change in the law, or an amendment. While we do not at the present advocate a general test, yet we believe that the time is not far distant when every animal, whether it be pure blood or grade, will be sold under a certificate, certifying that the animal is free from tuberculosis.

The Commissioners are aware that they have expended a large amount of money the last two years and are responsible for many things, but they did not take the responsibility of expending one dollar over the appropriation until after consulting the Governor and Council pertaining to the business. And while they are servants of the State, if they have performed their duties honestly and faithfully and in accordance with the law, treating all parties fairly, without fear or favor, then the Commissioners are clear, and the responsibility falls upon the people. And it is only fair and in the line of business principles, so long as the people demand the work to be done, that they should see to it through their representatives in the Legislature

that sufficient funds be provided, or in other words, the Governor and Council be authorized to pay out of any moneys not otherwise appropriated, whenever the appropriation is not sufficient to meet the demands made upon the Commissioners, as the Commissioners under the present laws are obliged to act whether there are sufficient funds available or not.

It will make no difference whether there are Cattle Commissioners or not, or whether the State appropriates money to pay for diseased animals or not, the producers of dairy products will find in the future that it will be of great financial advantage to them, to guarantee to the consumers of their products that they are produced from healthy herds; and those who do not look after this end of the business will be obliged to accept the low price for their products. And this will bring about a still stronger sentiment among the consumers of dairy products, that the producers are doing all in their power to satisfy them that their products are pure and healthy. We appeal to all educational and scientific sources and especially the agricultural press, to inform the people of all preventives and practical experiments and up-to-date methods in order that they be educated to the latest and most important issues relative to tuberculosis among our herds.

HON. F. O. BEAL, *Pres.*, Bangor.
JOHN M. DEERING, *Secy.*, Saco.
F. S. ADAMS, Bowdoinham.

PUBLIC LAWS OF MAINE, 1905, CHAPTER 83.

An Act in addition to chapter nineteen of the Revised Statutes relating to contagious diseases among cattle.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

Section 1. It shall be the duties of the assessors of all cities, towns and plantations to keep a record of all pure blooded cattle kept for breeding purposes, and shall report to the secretary of the Cattle Commissioners on or before the first day of July of each year, the name of the owner, number of each herd, age and sex, such reports to be made upon blanks furnished by the Cattle Commissioners.

Section 2. All persons selling pure blooded cattle or cattle represented to be pure blooded, for breeding purposes, shall, before delivery, make a report to said commissioners on blanks furnished by them on application, stating the number of cattle sold, their age and sex and to whom sold, and before delivery thereof such cattle shall be tested with tuberculin and a certificate of health be given by said commissioners or some person duly authorized by them to the seller and purchaser; provided that no such certificate shall be required in case the cattle so sold shall have been tested within six months under the direction of the catttle commissioners and a certificate of health granted by them within that time.

Section 3. Any person bringing pure blooded cattle into this State for breeding purposes shall report to the commissioners the name and residence of seller, number purchased, age and sex upon blanks furnished by the commissioners upon application. Such cattle shall remain upon the purchaser's premises thirty days from the date of arrival and within that time be tested by order of the commissioners. But nothing herein contained shall be construed as requiring the testing of calves under four months old.

Section 4. Whoever violates any provision of the three preceding sections shall be fined not exceeding fifty dollars for each offense.

OFFICERS OF AGRICULTURAL SOCIETIES.

Name of Society.	President.	P. O. Address.	Secretary.	P. O. Address.	Treasurer.	P. O. Address.
Maine State Agricultural	B. J. Libby	Oakland	J. L. Lowell	Auburn	E. G. Eveleth	Auburn.
Eastern Maine Fair Association	F. O. Beal	Bangor	E. L. Sterns	Bangor	A. S. Field	Bangor.
Central Maine Fair Association	E. P. Mayo	Waterville	Harold E. Cook	Waterville	Elmer E. Smith	Waterville.
Maine State Pomological	Z. A. Gilbert	North Green	D. H. Knowlton	Farmington	Ellis L. Lincoln	Wayne.
Maine State Poultry and Pet Stock Association	Silas Bartlett	Lewiston	A. L. Merrill	Auburn	T. H. Sclater	Auburn.
Aroostook, Northern Maine Fair Association	Frank P. Grant	Fort Fairfield	E. T. McGlauflin	Presque Isle	A. E. Irving	Presque Isle.
Aroostook, Madawaska	Eloi Albert	Up'r Madawaska	Remi Daigle	Up'r Madawaska	Alexis K. Cyr	St. David.
Cumberland County	J. L. Robinson	South Windham	C. H. Leighton	Cumberland M'ls	F. D. Scammon	Gorham.
Cumberland Farmers' Club	M. M. Burnham	Cumberland Ctr.	E. W. Winslow	Woodfords, R. F. D. 2.	N. M. Shaw	Cumberland Center R. F. D. 1.
Cumberland, Bridgton Farmers' and Mechanics' Club	Edwin Pingree	Denmark	C. L. Ames	Bridgton	J. S. Ames	Bridgton.
Cumberland, New Gloucester and Danville	E. K. Merrill	R. F. D. 2, Auburn	J. P. Witham	New Gloucester	Geo. W. Haskell	New Gloucester.
Cumberland, Freeport Agricultural Society	W. C. Anderson	Freeport	Willis Snow	Freeport	S. H. Fitts	Freeport.
Cumberland, Freeport Poultry Association	V. C. Morton	Freeport	Geo. P. Coffin	Freeport	L. E. Curtis	Freeport.
Franklin County	Herman Corbett	Farmington	Charles F. Smith	Farmington	Geo. M. Currier	Farmington.
Franklin, North	D. D. Graffam	Phillips	J. B. Morrison	Phillips	C. N. French	Phillips.
Hancock County	F. P. Merrill	Bluehill	C. S. Snowman	Bluehill	M. P. Hinckley	Bluehill.
Hancock, North	A. D. Archer	Clifton	A. N. Jewett	Amherst	J. H. Patten	Amherst.
Hancock, North Ellsworth Farmers' Club	Francis McGown	Ellsworth R. 3	H. F. Maddocks	Ellsworth Route 3	A. E. Maddocks	Nicolin.
Hancock, Eden	Charles F. King	Eden	Ephraim Alley	Eden	W. L. Alley	Eden.
Kennebec County	John H. Swift	Oakland, F. R. D. 36	L. O. Tebbetts	Readfield	C. H. Stevens	Readfield.
Kennebec, South	L. A. Howe	Augusta, F. R. D. 2	A. N. Douglass	Gardiner, R. F. D. 9	Jasper S. Gray	Windsorville, R. F. D. 54.
Knox, North	E. E. Thurston	Union	Geo. C. Hawes	South Union	H. L. Grinnell	Union.
Lincoln County	Chas. E. Peaslee	Alna	A. L. Shaw	Damariscotta	E. F. Metcalf	Damariscotta.
Lincoln, Bristol	J. W. P. Goudy	Bristol	Joel A. Little	Bristol	Chas. Woodward	Damariscotta.

Oxford County	Wm. J. Wheeler	So. Paris	W.O.Frothingh'm	So. Paris	W.O.Frothingh'm	So. Paris.
Oxford, West	H. D. Harnden	E. Fryeburg	B. W. McKeen	Fryeburg	W. R. Tarbox	Fryeburg.
Oxford, North	Charles T. Poor	Andover	John F Talbot	Andover	Sidney F. Abbott	Andover.
Oxford, Androscoggin Valley	A. L. Stanwood	Rumford Falls	O. M. Richardson	Canton	T. B. W. Stetson	Canton.
Oxford, Riverside Park Association	H. S. Hastings	Newry	L. A. Hall	Bethel	F. L. Edwards	Bethel.
Penobscot, West	C. L. Jones	Corinna	E. E. Colbath	Exeter	F. C. Barker	Exeter.
Penobscot, North	S. T. Mallett	Springfield	B. D. Averill	Prentiss	C. M. Lombard	Springfield.
Penobscot, Orrington	Albert G. Dole	So. Brewer	N. A. Nickerson	So Orrington	N. A. Nickerson	So. Orrington.
Penobscot, Newport Agricultural and Pomological Society	C. E. Smith	Newport	J. A. Merrill	Newport	C. E. Jones	Newport.
Sagadahoc County	A. S. Dunning	North Harpswell	George R. Tedford	Topsham	Lyman E. Smith	Brunswick.
Sagadahoc, Richmond Farmers' and Mechanics' Club	George M. Curtis	Richmond	H. E. Alexander	Richmond	D. W. Alexander	Richmond.
Somerset County	Ernest Hilton	Anson	J. F. Withee	Madison	E. H. Athearn	Anson.
Somerset, East	Lewis Fish	Hartland	E. A. Webber	Hartland	F. S. Burrill	Hartland.
Somerset, Central	C. Davis Miller	Skowhegan	Ansel Holway	Skowhegan	E. D. Packard	Skowhegan.
Somerset, Bingham	George Gordon	Bingham	H. B. Whipple	Bingham	G. Goodrich	Bingham.
Waldo County	Horace Chenery	Belfast	Arthur Ritchie	Belfast	Wm. A. Mason	Belfast.
Waldo and Penobscot	C. M. Conant	Winterport	F. H. Bowden	Monroe	E. C. Newcomb	South Newburg.
Waldo, Unity Park Association	Wm. H. Kimball	Burnham	E. T. Reynolds	Unity	E. T. Reynolds	Unity.
Washington County	A. E. Lincoln	Dennysville	J. M. Morgan	Pembroke	A. E. Lincoln	Dennysville.
Washington, West	A. H. Chandler	Columbia Falls	S. H. Allen	Columbia Falls	W. H. Allen	Columbia Falls.
York, Shapleigh and Acton	A. M. Mann	Shapleigh	Fred K. Bodwell	Acton	W. P. Ferguson	Springvale.

ANALYSIS OF EXHIBITION.

Name of Society.	Number of horses and colts.	Number of thoroughbred bulls and bull calves.	Number of thoroughbred cows, heifers and heifer calves.	Number of grade cows, heifers and heifer calves.	Number of oxen and steers.	Number of animals for beef.	Number of cattle shown in herds.	Total number of neat stock.	Number of sheep.	Number of swine.	Number of poultry, (coops).
Maine State Poultry and Pet Stock Association	-	-	-	-	-	-	-	-	-	-	1,350
Aroostook, Northern Maine Fair Association	123	23	63	20	4	-	36	146	34	13	116
Aroostook, Madawaska	32	-	-	27	13	-	-	40	17	-	-
Cumberland County	80	45	67	31	188	10	87	428	32	54	164
Cumberland Farmers' Club	10	5	24	24	32	4	20	89	-	-	64
Cumberland, Bridgton Farmers' and Mechanics' Club	27	6	15	18	64	6	8	117	-	25	47
Cumberland, New Gloucester and Danville	30	4	7	36	24	2	8	81	20	20	4
Cumberland, Freeport Agricultural Society	16	3	-	22	2	-	-	27	12	43	198
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-	-	552
Franklin County	101	39	118	84	268	26	48	583	188	5	111
Franklin, North	49	4	25	28	102	9	25	193	67	1	3
Hancock County	25	10	5	40	50	25	-	130	25	8	10
Hancock, North	27	-	-	16	8	-	-	24	9	-	3
Hancock, North Ellsworth Farmers' Club	2	6	7	9	4	-	2	26	-	-	6
Hancock, Eden	5	3	27	15	-	-	-	25	6	8	15
Kennebec County	45	18	35	40	142	15	42	292	22	27	36
Kennebec, South	31	7	7	31	124	9	15	179	9	12	30
Knox, North	41	4	11	11	116	4	14	146	13	2	11
Lincoln County	49	3	11	6	20	4	13	57	4	13	26
Lincoln, Bristol	8	1	2	11	20	-	-	34	4	-	7
Oxford County	66	34	64	109	120	10	36	373	153	7	90
Oxford, West	65	7	41	25	110	12	16	211	25	14	30
Oxford, North	38	2	2	9	25	7	6	51	14	16	17
Oxford, Androscoggin Valley	71	210	12	26	98	6	16	249	-	8	24
Oxford, Riverside Park Association	52	14	40	24	60	-	18	156	27	16	9

Penobscot, West	50	14	40	69	26	2	6	157	36	2	30
Penobscot, North	44	4	15	15	8	10	20	72	14	-	10
Penobscot, Orrington	7	-	-	6	6	-	-	12	6	-	-
Penobscot, Newport Agricultural and Pomological Society	31	1	10	7	8	-	-	26	1	5	20
Sagadahoc County	50	46	120	90	108	16	84	375	23	50	267
Sagadahoc, Richmond Farmers' and Mechanics' Club	21	1	2	22	9	-	22	55	10	10	13
Somerset County	52	5	23	39	64	24	5	160	135	-	40
Somerset, East	41	4	7	61	22	5	30	99	27	17	10
Somerset, Central	63	7	16	58	40	-	-	121	57	67	-
Somerset, Bingham	28	-	2	5	6	-	-	13	9	18	1
Waldo County	26	7	27	33	20	11	57	155	30	15	15
Waldo and Penobscot	54	12	14	41	84	20	15	186	43	5	35
Waldo, Unity Park Association	56	14	20	16	40	13	24	127	21	25	9
Washington County	27	5	9	24	8	-	36	82	12	-	14
Washington, West	61	9	21	32	28	-	-	90	38	4	28
York, Shapleigh and Acton	6	2	-	14	100	8	-	124	6	2	24
	1,610	579	909	1,194	2,171	258	709	5,511	1,149	512	3,439

ANALYSIS OF AWARDS.

Name of Society.	Amount of premiums awarded trotting bred stallions.	Amount of premiums awarded trotting bred brood mares.	Amount of premiums awarded draft stock stallions.	Amount of premiums awarded draft stock brood mares.	Amount of premiums awarded family horses.	Amount of premiums awarded gentlemen's drivers.	Amount of premiums awarded matched carriage horses.	Amount of premiums awarded colts.	Amount of premiums awarded horses for draft.
Maine State Poultry and Pet Stock Association	-	-	-	-	-	-	-	-	-
Aroostook, Northern Maine Fair Association	$33 00	-	$107 00	$50 00	-	$6 00	-	$163 00	$75 00
Aroostook, Madawaska	-	-	-	4 50	$3 00	-	$3 50	2 50	5 75
Cumberland County	50 00	$30 00	-	-	20 00	15 00	-	25 00	57 00
Cumberland Farmers' Club	5 00	3 00	-	-	-	-	-	9 00	13 00
Cumberland, Bridgton Farmers' and Mechanics' Club	8 00	6 00	-	4 00	6 00	-	14 00	18 00	37 00
Cumberland, Freeport Agricultural Society	-	3 00	-	-	-	-	-	9 00	10 00
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-
Franklin County	16 50	12 00	12 00	6 00	20 00	20 00	13 00	28 00	46 00
Franklin, North	3 00	-	4 00	-	12 90	7 00	3 50	2 25	6 00
Hancock County	25 00	12 00	5 00	-	-	6 00	-	20 00	-
Hancock, North	-	2 00	2 00	2 00	2 00	4 50	2 00	3 00	12 50
Hancock, North Ellsworth Farmers' Club	-	-	-	-	-	-	-	4 00	8 00
Hancock, Eden	-	-	-	-	3 00	-	-	2 50	-
Kennebec County	24 00	29 00	8 00	22 50	21 00	9 00	5 00	38 00	18 00
Kennebec, South	3 75	4 50	-	-	2 65	9 75	5 00	23 50	14 00
Knox, North	5 25	3 15	-	5 25	3 15	2 63	2 63	24 05	20 21
Lincoln County	5 00	5 00	-	3 00	3 00	10 00	5 00	10 75	17 00
Lincoln, Bristol	-	-	-	-	-	-	-	-	2 00
Oxford County	57 00	48 00	-	-	-	45 00	15 00	50 00	48 00
Oxford, West	36 00	12 00	-	-	-	-	12 00	24 50	47 00
Oxford, North	-	5 50	3 00	3 00	-	-	-	7 25	24 00
Oxford, Androscoggin Valley	23 00	10 00	3 00	3 00	-	10 00	10 00	6 00	72 00

Oxford, Riverside Park Association	12 00	53 75	6 00	3 75	-	3 00	-	16 50	50 00
Penobscot, West	5 00	7 00	8 00	-	-	6 00	-	22 00	109 00
Penobscot, North	-	2 50	2 50	2 50	2 50	2 00	-	12 00	3 25
Penobscot, Orrington	-	-	-	2 50	-	4 50	-	6 00	-
Penobscot, Newport Agricultural and Pomological Society	5 00	5 00	3 00	3 00	-	3 00	3 00	9 00	6 00
Sagadahoc County	21 00	10 00	6 00	10 00	9 00	15 00	-	49 00	45 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	-	-	-	1 00	3 00	-	-	11 50	-
Somerset County	8 50	4 50	-	2 00	4 50	4 50	2 00	21 50	15 00
Somerset, East	12 50	6 00	-	2 50	-	7 50	3 75	14 75	56 75
Somerset, Central	29 00	8 50	29 50	5 00	5 00	13 00	16 50	38 50	14 00
Somerset, Bingham	-	-	-	5 50	-	-	2 00	8 00	20 00
Waldo County	4 00	6 00	-	-	-	2 00	-	2 00	13 00
Waldo and Penobscot	36 00	12 00	6 00	9 00	10 00	12 00	-	26 00	53 00
Waldo, Unity Park Association	9 00	6 00	16 00	6 00	6 00	6 00	6 00	27 50	15 00
Washington County	5 00	9 00	-	7 00	-	-	-	20 50	11 00
Washington, West	48 00	-	40 00	-	-	100 00	13 00	84 00	46 00
York, Shapleigh and Acton	-	-	-	-	3 50	3 50	-	-	-
Total	$489 50	$315 40	$261 00	$163 00	$140 20	$326 88	$136 88	$839 05	$989 46

ANALYSIS OF AWARDS—Continued.

Name of Society.	Amount of premiums awarded thorough-bred bulls and bull calves.	Amount of premiums awarded thorough-bred cows, heifers, and heifer calves.	Amount of premiums awarded grade cows, heifers, and heifer calves.	Amount of premiums awarded herds.	Amount of premiums awarded working oxen and steers.	Amount of premiums awarded matched oxen and steers.	Amount of premiums awarded trained steers.	Amount of premiums awarded beef cattle.	Amount of premiums awarded town teams.	Amount of premiums awarded oxen and steers for draft.
Maine State Poultry and Pet Stock Association	-	-	-	-	-	-	-	-	-	-
Aroostook, Northern Maine Fair Association	$171 00	$423 00	$27 50	$68 00	$8 00	-	-	-	-	-
Aroostook, Madawaska	-	-	7 25	-	2 50	4 00	-	-	-	4 00
Cumberland County	110 00	130 00	65 00	45 00	35 00	30 00	8 00	22 00	16 00	68 00
Cumberland Farmers' Club	12 00	28 00	31 50	20 00	9 00	14 00	13 00	9 00	25 50	24 00
Cumberland, Bridgton Farmers' and Mechanics' Club	13 50	37 00	39 00	8 00	6 00	47 50	-	6 00	16 00	60 00
Cumberland, Freeport Agricultural Society	4 00	6 50	4 75	-	2 00	-	-	-	-	-
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-	-
Franklin County	69 00	128 50	72 25	19 50	20 50	39 00	9 00	23 50	141 00	50 00
Franklin, North	3 40	17 70	10 45	11 00	5 75	10 40	-	8 00	27 91	6 00
Hancock County	20 00	10 00	40 00	-	22 00	10 00	-	8 00	-	28 00
Hancock, North	-	-	11 50	-	4 50	-	-	-	-	-
Hancock, North Ellsworth Farmers' Club	10 00	18 00	19 50	-	2 00	-	-	-	-	-
Hancock, Eden	9 00	6 00	6 00	-	-	-	-	-	-	-
Kennebec County	39 50	52 00	37 00	24 00	55 00	18 00	6 00	30 00	52 00	39 00
Kennebec, South	18 50	13 00	36 95	14 25	25 75	29 50	10 25	18 50	42 00	21 25
Knox, North	8 83	11 55	12 63	10 50	9 45	8 40	-	3 15	26 25	30 45
Lincoln County	-	23 25	5 50	-	8 00	19 70	3 00	5 00	12 00	44 00
Lincoln, Bristol	-	1 75	7 00	-	6 50	-	-	-	-	9 25
Oxford County	147 00	170 00	204 00	36 00	141 00	65 00	-	20 00	98 00	154 00
Oxford, West	70 00	135 00	100 00	72 00	28 00	30 00	9 00	14 00	76 00	108 00
Oxford, North	-	-	5 35	5 00	9 50	6 75	-	6 75	11 00	10 00
Oxford, Androscoggin Valley	34 00	49 00	17 00	21 00	43 00	37 00	10 00	9 00	56 00	39 00
Oxford, Riverside Park Association	26 25	46 00	10 90	8 00	14 25	9 37	-	-	24 00	34 00
Penobscot, West	42 00	84 00	62 25	6 00	30 00	-	6 00	2 00	-	-
Penobscot, North	5 00	6 00	10 00	7 50	3 00	-	-	-	-	3 00
Penobscot, Orrington	-	-	3 75	-	7 50	-	-	-	-	-

Penobscot, Newport Agricultural and Pomological Society	2 00	3 00	4 00	–	–	5 00	8 00	–	–	–
Sagadahoc County	128 00	229 50	129 50	65 00	64 50	44 50	9 00	18 00	50 00	170 50
Sagadahoc, Richmond Farmers' and Mechanics' Club	1 00	1 60	6 35	3 00	–	1 30	60	–	–	–
Somerset County	5 00	14 25	25 25	3 00	17 50	15 25	3 00	13 00	23 00	17 00
Somerset, East	12 50	22 50	52 50	22 00	23 50	–	3 50	6 75	–	–
Somerset, Central	14 50	20 50	47 00	–	21 50	16 50	–	–	22 00	14 00
Somerset, Bingham	–	7 00	3 25	–	–	2 00	–	–	–	10 00
Waldo County	4 00	35 00	13 00	20 00	15 00	21 00	8 00	5 00	20 00	15 00
Waldo and Penobscot	41 00	64 00	97 00	33 00	35 00	37 00	9 00	38 00	37 00	38 00
Waldo, Unity Park Association	28 00	28 00	32 25	25 00	22 00	13 50	–	24 75	10 00	12 00
Washington County	12 00	42 50	41 00	–	12 50	–	–	–	–	–
Washington, West	59 00	95 00	74 00	–	66 00	–	–	–	–	24 00
York, Shapleigh and Acton	1 50	–	10 50	–	6 00	30 75	–	6 00	45 00	12 00
Total	$1,121 48	$1,959 10	$1,382 63	$546 75	$781 70	$565 42	$115 35	$296 40	$830 66	$1,044 45

ANALYSIS OF AWARDS—Concluded.

Name of Society.	Amount of premiums awarded sheep.	Amount of premiums awarded swine.	Amount of premiums awarded poultry.	Amount of premiums awarded grain and root crops.	Amount of premiums awarded fruit and flowers.	Amount of premiums awarded bread and dairy products.	Amount of premiums awarded honey, sugar and syrups.	Amount of premiums awarded agricultural implements.	Amount of premiums awarded household manufactures and needle work.	Amount of premiums awarded objects not named above.	Total amount of premiums and gratuities awarded.
Maine State Poultry and Pet Stock Association	-	-	$1,717 75	-	-	-	-	-	-	-	$1,717 75
Aroostook, Northern Maine Fair Association	$116 00	$59 00	101 50	$89 00	$97 00	$32 00	$28 40	-	$77 40	$289 70	$2,021 50
Aroostook, Madawaska	8 00	-	-	8 75	2 25	-	-	$2 00	7 75	-	65 75
Cumberland County	21 00	12 00	260 50	22 50	30 25	35 00	-	-	42 00	14 50	1,163 75
Cumberland Farmers' Club	-	-	65 50	37 75	22 50	9 45	9 70	-	26 55	4 75	392 20
Cumberland, Bridgton Farmers' and Mechanics' Club	-	12 00	36 00	45 00	30 00	25 00	15 00	11 00	25 00	25 00	550 60
Cumberland, Freeport Agricultural Society	2 50	2 00	39 00	8 67	17 05	6 30	1 25	-	19 70	119 45	255 17
Cumberland, Freeport Poultry Association	-	-	463 71	-	-	-	-	-	-	8 00	471 71
Franklin County	98 25	12 50	98 25	36 65	50 60	14 75	13 50	27 45	69 20	92 00	1,258 90
Franklin, North	16 75	1 00	1 50	9 35	5 90	3 20	-	-	21 55	3 50	202 01
Hancock County	10 00	4 00	5 00	75 75	23 50	18 75	5 00	-	18 15	-	366 15
Hancock, North	2 25	-	1 50	20 55	23 10	-	1 35	-	40 80	7 60	143 15
Hancock, North Ellsworth Farmers' Club	-	-	5 00	28 70	22 60	7 50	1 80	3 00	21 80	-	151 90
Hancock, Eden	1 00	2 00	3 50	27 00	18 00	1 00	-	-	4 80	-	83 80
Kennebec County	22 00	18 00	30 00	125 00	101 00	32 50	3 50	-	70 00	-	929 00
Kennebec, South	6 00	3 00	18 65	13 55	25 50	13 75	1 50	-	56 80	40 00	471 85
Knox, North	5 78	3 15	7 56	7 40	20 11	8 14	7 82	-	50 08	14 75	312 32
Lincoln County	1 00	5 00	6 45	16 30	19 80	4 50	-	-	29 75	12 50	274 50
Lincoln, Bristol	2 50	-	4 25	10 40	5 00	-	2 00	-	10 50	22 65	83 80
Oxford County	83 00	22 00	40 40	47 75	66 25	29 25	19 00	13 50	65 00	324 00	2,008 15
Oxford, West	13 00	22 00	15 00	10 20	10 10	7 00	5 00	-	16 30	150 00	1,022 10
Oxford, North	8 50	6 75	9 75	12 20	7 50	15 50	3 00	-	14 70	11 45	186 45
Oxford, Androscoggin Valley	-	13 00	9 00	25 25	15 25	13 00	3 00	6 00	24 25	9 05	569 80

Oxford, Riverside Park Association	12 00	11 50	7 00	7 75	8 40	12 15	–	–	14 20	59 75	450 52
Penobscot, West	16 50	4 00	22 25	36 00	23 50	14 25	4 95	–	105 10	21 32	637 12
Penobscot, North	4 75	–	4 75	10 00	50 00	9 75	5 00	–	58 11	–	204 11
Penobscot, Orrington	2 00	–	–	13 15	19 50	3 25	1 25	–	33 00	10 25	106 65
Penobscot, Newport Agricultural and Pomological Society	2 00	6 00	12 25	–	9 70	6 75	–	–	12 50	50 00	158 20
Sagadahoc County	28 00	59 00	175 00	101 00	130 50	78 25	8 50	–	86 75	346 00	2,086 50
Sagadahoc, Richmond Farmers' and Mechanics' Club	2 30	2 50	3 55	10 00	8 90	1 45	85	–	8 30	3 35	70 55
Somerset County	43 75	–	14 50	12 70	2 55	1 00	–	–	12 35	–	285 60
Somerset, East	18 00	9 00	10 50	20 00	10 85	8 45	2 85	–	19 15	36 65	382 45
Somerset, Central	25 50	13 00	50 75	47 35	68 25	36 50	–	8 00	16 50	9 00	589 85
Somerset, Bingham	2 50	3 50	50	3 00	3 00	1 50	–	1 50	2 00	–	75 25
Waldo County	43 00	3 00	37 00	51 00	–	–	–	–	43 00	30 00	393 00
Waldo and Penobscot	46 00	20 00	20 00	59 00	38 50	24 50	1 00	–	131 25	–	933 25
Waldo, Unity Park Association	17 25	8 75	3 75	31 75	27 00	10 50	2 25	6 00	36 75	17 00	454 00
Washington County	7 00	9 00	11 75	69 25	22 15	17 90	8 25	–	36 30	–	342 10
Washington, West	72 00	21 00	25 50	232 50	84 20	23 75	9 50	–	185 05	46 40	1,348 90
York, Shapleigh and Acton	4 00	1 75	18 50	75 00	30 00	12 00	–	–	33 25	70 00	363 25
Total	$764 08	$369 40	$3,357 32	$1,460 17	$1,150 26	$538 54	$165 22	$78 45	$1,545 64	$1,848 62	$23,583 01

FINANCES.

Name of Society.	Amount received from State.	Receipts for membership.	Receipts from loans.	Receipts from entry fees for trotting purses.	Receipts from all other sources.	Total receipts.
Maine State Pomological	$1,000 00	$112 00	–	–	$144 92	$1,256 92
Maine State Poultry and Pet Stock Association	535 40	46 00	–	–	2,273 23	2,854 63
Aroostook, Northern Maine Fair Association	624 45	26 00	–	$350 00	5,490 55	6,491 00
Aroostook, Madawaska	28 80	–	–	–	43 30	72 10
Cumberland County	340 33	–	–	215 00	4,320 38	4,875 71
Cumberland Farmers' Club	167 50	40 00	$95 00	275 00	1,586 96	2,164 46
Cumberland, Bridgton Farmers' and Mechanics' Club	206 54	–	–	50 00	603 50	860 04
Cumberland, Freeport Agricultural Society	70 17	1 00	112 00	115 75	562 25	861 17
Cumberland, Freeport Poultry Association	148 83	8 50	–	–	529 49	686 82
Franklin County	380 61	749 00	–	17 50	3,458 85	4,605 96
Franklin, North	78 06	288 00	–	36 25	709 08	1,111 39
Hancock County	153 04	–	–	60 00	1,708 89	1,921 93
Hancock, North	47 57	–	–	–	585 29	632 86
Hancock, North Ellsworth Farmers' Club	–	3 00	350 00	13 50	476 50	843 00
Hancock, Eden	34 98	–	–	–	591 60	626 58
Kennebec County	326 51	5 00	–	250 00	1,635 00	2,216 51
Kennebec, South	164 84	–	–	40 00	1,048 73	1,253 57
Knox, North	118 19	–	–	–	1,589 74	1,707 93
Lincoln County	116 40	21 00	–	116 75	1,548 49	1,802 64
Lincoln, Bristol	37 80	75	60 00	–	–	98 55
Oxford County	787 15	6 00	–	783 50	5,515 10	7,091 75
Oxford, West	258 76	150 00	–	263 75	3,120 56	3,793 07
Oxford, North	62 54	5 00	–	95 00	763 25	925 79

Oxford, Androscoggin Valley	208 60	11 00	-	105 00	1,836 52	2,161 12
Oxford, Riverside Park Association	248 37	-	-	254 00	748 10	1,250 47
Penobscot, West	249 36	-	-	227 50	1,787 20	2,264 06
Penobscot, North	82 04	-	-	-	268 71	350 75
Penobscot, Orrington	41 17	20 00	-	43 75	478 99	583 91
Penobscot, Newport Agricultural and Pomological Society	-	-	-	158 75	975 35	1,134 10
Sagadahoc County	701 55	437 00	3,100 00	750 00	5,246 93	10,235 48
Sagadahoc, Richmond Farmers' and Mechanics' Club	32 53	1 50	-	-	122 75	156 78
Somerset County	88 85	-	-	-	667 05	755 90
Somerset, East	167 66	60 00	-	270 00	1,278 45	1,776 11
Somerset, Central	65 73	153 00	-	75 00	1,434 81	1,728 54
Somerset, Bingham	-	42 00	-	-	116 00	158 00
Waldo County	-	80 00	325 00	-	1,740 79	2,145 79
Waldo and Penobscot	374 30	80 00	22 50	1,200 00	2,836 09	4,512 89
Waldo, Unity Park Association	132 18	3 00	-	198 50	625 25	958 93
Washington County	89 96	29 00	-	84 25	767 80	971 01
Washington, West	439 41	6 00	275 00	190 00	3,391 47	4,301 88
York, Shapleigh and Acton	126 02	208 00	60 00	-	66 63	460 65
Total	$8,736 20	$2,591 75	$1,399 50	$6,238 75	$62,694 55	$84,660 75

FINANCES—Concluded.

Name of Society.	Amount expended in improvements.	Amount expended in trotting purses.	Expenses during the fair.	Amount expended for all other purposes.	Total amount paid out including premiums and gratuities.	Value of property belonging to the society.	Amount of liabilities.
Maine State Pomological	-	-	-	-	$1,075 80	-	-
Maine State Poultry and Pet Stock Association	$682 81	-	$494 30	-	2,894 86	$1,000 00	-
Aroostook, Northern Maine Fair Association	2,000 00	1,250 00	1,616 96	-	6,888 46	10,000 00	$700 00
Aroostook, Madawaska	-	-	4 35	-	70 10	-	-
Cumberland County	253 67	832 50	776 85	$971 14	3,997 91	5,500 00	300 00
Cumberland Farmers' Club	300 00	587 50	150 00	882 30	2,312 00	3,000 00	175 00
Cumberland, Bridgton Farmers' and Mechanics' Club	100 00	500 00	125 00	40 00	1,315 00	4,000 00	-
Cumberland, Freeport Agricultural Society	64 38	500 00	82 50	17 81	919 86	2,000 00	850 00
Cumberland Freeport Poultry Association	18 78	-	107 50	100 76	698 75	250 00	75 00
Franklin County	1,105 75	842 50	1,365 65	-	4,572 80	415,000 00	-
Franklin, North	-	265 00	-	636 04	1,103 05	3,802 34	2,405 76
Hancock County	250 00	581 25	515 14	-	1,712 54	5,000 00	-
Hancock, North	-	-	396 65	-	539 80	200 00	-
Hancock, North Ellsworth Farmers' Club	100 00	99 00	100 00	-	450 90	1,500 00	350 00
Hancock, Eden	220 77	-	358 24	-	662 81	1,500 00	550 00
Kennebec County	75 00	650 00	225 00	85 00	1,964 00	4,000 00	1,555 00
Kennebec, South	21 70	212 50	377 00	465 55	1,548 60	2,000 00	-
Knox, North	161 00	330 00	526 91	397 19	1,727 42	1,000 00	400 00
Lincoln County	-	425 50	873 34	-	1,573 34	1,200 00	247 76
Lincoln, Bristol	16 77	-	64 99	42 34	207 90	1,200 00	139 97
Oxford County	1,476 71	1,520 00	1,182 65	478 30	6,665 81	12,000 00	-
Oxford, West	45 00	1,015 00	175 90	1,535 07	3,793 07	10,000 00	2,400 00
Oxford, North	50 00	343 50	350 00	-	929 95	1,000 00	190 00

Oxford, Androscoggin Valley	232 47	460 00	317 19	220 80	1,800 26	4,000 00	2,600 00
Oxford, Riverside Park Association	125 00	585 00	120 00	150 00	1,430 52	2,000 00	180 05
Penobscot, West	269 00	446 25	464 35	282 06	2,098 72	6,000 00	4,300 00
Penobscot, North	25 00	-	75 00	20 00	324 11	-	-
Penobscot, Orrington	40 00	215 00	73 67	72 20	507 52	1,000 00	26 00
Penobscot, Newport Agricultural and Pomological Society	1,957 00	540 00	256 91	-	2,912 11	4,240 00	1,391 30
Sagadahoc County	500 00	1,745 00	2,388 02	3,516 46	10,235 98	7,000 00	3,100 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	35	-	32 50	42 25	145 65	100 00	-
Somerset County	19 43	266 00	188 28	-	759 31	800 00	-
Somerset, East	110 00	975 00	75 00	616 11	2,158 56	1,900 00	700 00
Somerset, Central	500 00	750 00	125 00	200 00	2,164 85	4,500 00	1,500 00
Somerset, Bingham	-	-	76 75	-	152 00	-	-
Waldo County	2,100 00	288 33	251 81	-	3,033 14	2,500 00	-
Waldo and Penobscot	500 00	2,625 00	1,227 60	-	5,285 85	10,000 00	-
Waldo, Unity Park Association	150 00	517 00	241 77	-	1,362 77	-	403 84
Washington County	52 87	242 40	137 85	199 18	974 40	2,000 00	1,050 00
Washington, West	250 00	630 00	1,354 31	739 74	4,322 95	2,421 02	1,526 27
York, Shapleigh and Acton	-	-	17 50	24 90	405 65	2,000 00	-
	$13,773 46	$20,239 23	$17,292 44	$11,735 14	$87,699 08	$535,613 36	$27,115 95

BULLETINS

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Bulletin 125 on Seed Inspection, Bulletins 127 and 133 on Fertilizer Inspection, Bulletin 129 on Feeding Stuff Inspection, Bulletins 135 and 136 on Food Inspection, and the part of Bulletin 137 on Meteorology and the Treasurer's Report are not here included.

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FIELD EXPERIMENTS IN 1905.

Charles D. Woods and J. M. Bartlett.

The Station had about 40 acres in co-operative field experiments in 1905. The mid-summer was too dry in the northernmost part of the State for satisfactory experiments except with potatoes. The inoculation experiments for legumes were failures because of the poor quality of the cultures used. As Aroostook County was practically free from late potato blight, spraying and dusting experiments for this fungus did not give decisive results. The following experiments are here reported.

Clark Method of Growing Grass for Hay.

Mr. Clark of Higganum, Conn., has for several years practiced intense cultivation for the production of hay with marked success. His method has been quite generally published in agricultural papers and this has led to the Station receiving many inquiries from correspondents as to the adaptability of this method to Maine conditions. Because of these inquiries the Station undertook to handle two acres of land as nearly as possible in accordance with Mr. Clark's published directions. A worn piece of grass land on rather heavy clay loam was selected for the purpose and plowed in the summer of 1903. This was harrowed about every fortnight with the Clark double action cutaway harrow. At the time the piece was plowed it was hoped that the frequent harrowing would break down the sod, and fine the soil so that a crop of winter rye could be grown. The turf proved too stubborn, however, and the ground was left

without a covering during the winter. No fertilizer was applied in 1903.

The spring of 1904 was unusually wet and backward so that the first harrowing in 1904 was necessarily delayed until June 3. It was at this time harrowed in two directions with the double action cutaway harrow, and then made level with the Clark smoothing harrow. It was harrowed five times after this before it was seeded.

August 16, there was applied at the rate of 800 pounds per acre a fertilizer made from 500 pounds fine bone tankage, 100 pounds nitrate of soda, 300 pounds acid phosphate and 150 pounds of muriate of potash. The 800 pounds of this mixture carried about 27 pounds nitrogen, 75 pounds available phosphoric acid, 115 pounds total phosphoric acid and 75 pounds potash. The field was then again harrowed with the double action harrow and made true with the smoothing harrow, and seeded with timothy and red top at the rate of 14 quarts of each per acre. The seed was harrowed in with the Clark smoothing harrow (without the leveling board) and then rolled. There was an excellent catch and when the snow came the last of November the field was in good shape for the winter.

The following spring (1905) there was applied 300 pounds per acre of a fertilizer carrying about 20 pounds of nitrogen, 8 pounds available phosphoric acid, 22 pounds total phosphoric acid and 50 pounds potash.

As soon as the grass made much growth it was apparent that the piece was overseeded and the grass plants were badly crowding each other. As the result the grass was much finer than timothy and red-top usually are. There was such a tangle of fine grasses at the bottom that it could not be cut clean with the mowing machine.

The field was mown the second week in July, at which time the timothy was a little past full bloom. The somewhat less than two acres yielded 6¼ tons of field cured hay. The second growth was not sufficient to warrant cutting. In our experience it is not practicable in the short season of growth to obtain two cuttings of the ordinary grasses. Clover can usually be depended upon to give two cuttings, but unless the first crop is cut too early for the best hay, timothy will give only one cutting a season in central and northern Maine.

The experiment clearly indicates the value of thorough preparation of the seed bed and liberal application of fertilizer for the production of grass. If half the quantity of seed had been used, the yield would probably have been greater and the hay of more desirable quality for horses.

The fertilizers used in growing this crop of 6 tons of hay cost about $40, and the seed and labor of preparation, seeding and harvesting cost about $37. In the next season and succeeding seasons the cost of fertilizers recommended by Mr. Clark and harvesting would be about $25 a year. If three successive crops equal to the first were obtained, the 18 tons of hay would be grown at a cost of a little more than $125. The hay would be worth according to the location of the farm in Maine from $8 to $12 a ton in the barn, or at an average price would bring about $180—a profit of $55 to pay the interest on the capital invested and taxes. With thinner seeding probably a larger crop would have been obtained. If the four tons per acre that Mr. Clark expects from the first cutting were obtained, the profits would be materially increased. It is to be noted that a very considerable part of the profit that Mr. Clark figures comes from the second crop that he can obtain in Connecticut with the 6 weeks longer growing season.

Although it is probable that thorough preparation and fertilization of the soil for hay will in the long run prove profitable even in Maine with its distance from markets, growing grass for the purpose of selling hay is probably not the best kind of agriculture for the average farmer in this State. In a few localities near to the larger cities hay farming may prove a profitable industry.

While thoroughly endorsing the general proposition that thorough preparation and high manuring of the land is essential to the highest success in grass raising, the Station does not recommend the adoption of the Clark method by Maine farmers, chiefly because it does not fit in with mixed farming and rotation of crops. The coarse products of the farm should be fed upon the farm and the manure returned to the land in order to maintain and increase fertility. Selling hay is selling fertility from the farm. Three tons of timothy and red-top remove* about 69 pounds of nitrogen, 27 pounds of phosphoric acid and

* Bulletin 107 of this Station, p. 137.

58 pounds potash that it will cost more than $18 to replace commercially.

The plan of a hay farm does not admit of rotation of crops. Rotations are very important in the proper and economical handling of land. For instance, if potatoes or corn are grown preceding grass, the land will be in equally good condition from fall plowing and once harrowing in the spring as from the frequent harrowings necessitated by summer seeding. In the rotation most of the cost of the preparation of the seed bed falls upon a money crop as potatoes, or corn, and not upon the next season's grass crop.

The seeding formula recommended by Mr. Clark does not contain clover. This is the most important forage plant that the Maine farmer can grow. It is rich in protein and is able to obtain its nitrogen from the air. While clover hay does not command as good a price as that from red-top and timothy, it can be grown at a less cost per ton and has a greater feeding value.

Soil Inoculation for Legumes from Artificial Cultures by the Help of Bacteria.

That legumes such as peas, clover, etc., can by the help of bacteria acquire atmospheric nitrogen through their roots has been a matter of common knowledge for 20 years. The bacteria produce enlargements upon the roots of the plants, which are called root nodules. Not all soils carry the proper organisms, but those deficient can be artificially inoculated. About ten years ago, under the name of Nitragin, commercial cultures were prepared in Germany for the purpose of inoculating sterile soils. This matter is discussed in considerable detail, together with certain experiments with nitragin, in the reports of this Station for 1897, 1898 and 1900. As a scientific curiosity nitragin was of great interest, but in practice it oftener failed to yield satisfactory results than to give them. The principles underlying the use of nitragin are of great practical importance, and many investigators are at work upon the problem. It was announced in an almost sensational article in the Century Magazine for October, 1904, that the U. S. Department of Agriculture had solved the problem of preparing active cultures in a convenient form for distribution. Later the department issued a bulletin*

* Bul. 71, Bureau of Plant Industry, U. S. Dept. Agr.

announcing this discovery and giving the results of a large number of co-operative experiments which seemed to confirm the great claims made for these cultures. Because the soil in New England, where peas and clover have been grown for generations, is very generally inoculated with the nodule forming bacteria, the Station cautioned farmers against the purchase of cultures other than in an experimental way. It seems now that the method itself is unsatisfactory.

Cultures for ordinary legumes were obtained by this Station from the Department at Washington and from the Nitro-Culture Company of West Chester, Pa. The cultures furnished by the company were given to us and we have no reason to think but that they acted in entire good faith and that they believed the method and the cultures they were sending out to be all that was claimed for them. Experiments were carried out by this Station in the summer of 1905 on quite a number of farms in different parts of the State with peas, clover and alfalfa. The results were negative, and because as stated below the failures were due to the culture, the results are not given in detail. While taken by themselves they would not be sufficient to offset the large number of favorable reports printed by the department in the bulletin above cited, they accord with those obtained by many practical men in New England. Why they failed is explained by a very full and careful study made by the New York State Station* in which it is not only shown that the cultures sent out by the department and the commercial companies in 1905 were, so far as examined, worthless, but their studies discredit the method used in the manufacture of the cultures. Their conclusions are summarized as follows:

"I. During the past two years much interest has been shown in the inoculation of legumes with bacteria to enable the legumes to obtain nitrogen from the air.

II. These bacteria have been distributed in a dried condition upon cotton. Before being applied to the seeds the cotton is put into a solution of chemicals and the bacteria allowed to multiply.

III. These packages of treated cotton have had a wide sale at high price—two dollars for a package sufficient to treat an acre—while the cost of production was less than ten cents.

* Bul. 270, N. Y. State Expt. Sta.

IV. This bulletin gives the results of a bacteriological examination of 18 such packages of cotton.

V. These examinations made it very evident that the packages were worthless for practical purposes.

VI. Substantially identical results upon six of these packages were obtained in five separate laboratories.

VII. It was shown that the failure of these cultures was inherent in the method of their preparation rather than in any knavery of their producers.

VII. While these results will explain the many failures from the use of cotton cultures they should not be understood as being opposed to the idea of treating the seed of legumes with living bacteria."*

The principle of soil inoculation from cultures is all right, but the method of preparation and shipment practiced by the department and the commercial companies cannot be depended upon. Fortunately for Maine farmers there is probably but little to be gained by inoculating soil for our common leguminous crops such as clover, peas and beans. If one desires to grow alfalfa, soy beans, cow peas, or other leguminous plants that are not usually grown in the State, the inoculation by the application of soil from a field that has grown the desired legume with an abundance of root tubercles is the only sure way yet devised. This inoculation, by the transfer of soil carrying the organism, has never given negative results so far as the writers know. While it is to be hoped that the difficulties that made nitragin a failure, and the equally unsatisfactory results from nitro-cultures may be speedily overcome, the commercial cultures now in the market and any that are likely to be offered in 1906 are apparently valueless for practical purposes.

Fertilizr Experiment in Field Culture of Garden Peas.

In Northern Maine where potatoes are the chief money crop, a common rotation is to follow the potatoes with clover and mixed grasses, seeding with grain, sometimes wheat, but more commonly oats. In Woodland, near Caribou, in the northern part of Aroostook county, a pea canning industry has been introduced by Geo. T. Goodwin and Company. The peas can be used in the rotation in the place of grain. The culture is very

* Bul. 270, N. Y. State Expt. Sta.

simple. The land is plowed in the late fall or early spring, and is treated the same as if grain is to be sown. The peas are planted with a grain drill, clover and mixed grasses if desired being sown at the same time. When the peas are in the right condition for canning, they are cut with a mowing machine and drawn to the factory where they are threshed, shelled and sorted by machinery. The yield in good seasons is about 2,500 pounds of shelled peas per acre, although 3,000 pounds is not an uncommon yield.

In 1905 the Station conducted two experiments on Mr. Goodwin's farms. While these were primarily intended as experiments upon inoculation of peas with artificial cultures, they served at the same time as partial fertilizer experiments. The account of the failure of the inoculation experiments due to the poor quality of the cultures both from the U. S. Department of Agriculture and the Nitro-Culture Company is given on page 8 and following. The report of the fertilizer experiments follows.

In growing potatoes only high grade fertilizers carrying 3 to 4 per cent of nitrogen are employed. Because of the readiness with which this class of fertilizers are obtained they are also quite commonly used for pea growing. When the soil is stocked with the proper organisms, peas, as other legumes, can obtain all, or practically all of their nitrogen from the free nitrogen of the air. The bacteria which enable the plants to do this are more active when the supply of combined nitrogen is limited. Thus it happens that when a fertilizer that furnishes all the nitrogen needed for a given crop of legumes is used, the plants avail themselves of this ready combined nitrogen and do not obtain any considerable amount from the air. In the experiments here reported fertilizers low in nitrogen were used.

EXPERIMENT AT HOME FARM.

The field used for this experiment was situated on a rather moist side hill with a slope to the south. The land was in a good state of cultivation and the greater part of it was planted to peas in 1904, while the rest was in grass. A section of four acres which appeared to be uniform in condition was selected for the experiment and divided into plots of one acre each. The division was so made that each plot covered an equal portion of the section which was in grass last season. The whole field

received a dressing of pea vines from the factory which were plowed under, also the following amounts of fertilizing materials were added to each plot.

Plot 1—400 lbs. acid phosphate, 250 lbs. muriate of potash.

Plots 2, 3, and 4—100 lbs. dried blood, 400 lbs. acid phosphate, 250 lbs. muriate of potash.

On May 23rd Alaska peas were planted with a grain drill at the rate of 2½ bushels to the acre. Those put on plot 1 were inoculated with the Nitro-Culture Company's culture, and those on plot 2 received no treatment. The seed used on plot 3 was treated with the U. S. Department of Agriculture's culture and that of plot 4 was not treated with any culture.

The field was visited June 27 and at that time the peas were about 8 inches high, of good color and appeared to be in a thrifty condition. The roots of some plants on each plot were examined and in every instance the nitrogen collecting bacteria nodules were found to be present. This shows, as was to be expected, that the field was thoroughly stocked with the nodule forming bacteria. There was no noticeable difference in the different plots either in size and thriftiness or in the number or character of the root nodules.

The field was visited again July 28th, but the weeds had then made such progress that it was not possible to make any comparisons of the different plots and the peas were nearly ripe enough to harvest.

On July 29 a part of plot No. 1 was harvested and on the 31st the harvesting of this plot was completed together with plots 2 and 3,—three acres per day being about all the factory could take care of. August 1st plot No. 4 was taken to the factory.

The yields of green peas after being threshed and screened are shown in the following table.

Plot 1. Phosphoric acid and potash, 1,747 pounds.

Plot 2. Nitrogen, phosphoric acid and potash, 1,388 pounds.

Plot 3. Nitrogen, phosphoric acid and potash, 1,307 pounds.

Plot 4. Nitrogen, phosphoric acid and potash, 1,431 pounds.

All of the yields are small, not much more than two-thirds of a crop being secured on account of the very dry season. The larger yield on plot 1 was probably due to some cause not directly connected with the experiment. It is hardly to be thought that the presence of the small amount of nitrogen used on plots 2, 3 and 4 could have any relation to the diminished

yield. The results show that this small amount of nitrogen was at least unnecessary.

EXPERIMENT ON SECOND FARM.

The experiment made at this farm was on a piece of land which had been in grass for several years and was in a rather low state of cultivation. It was not known to have ever been planted to peas and for this reason was considered an excellent piece on which to test the effect of the nitro-culture material. Four acres of the field was measured off and divided into plots of one acre each. After the sod was turned over and the land thoroughly harrowed it was dressed with 700 lbs. to the acre of the following mixture: nitrate of soda, 50 lbs.: acid phosphate 400 lbs.; muriate of potash 250 lbs. It will be noticed that a very light application of nitrogen was made, the idea being to apply just enough in the most available form for the immediate use of the plants up to the time when the nitrogen collecting bacteria could begin to work.

On May 25 the field was planted to Alaska peas. The seed used on two of the plots was inoculated and on two of them it was not treated.

The field was visited on June 27th and at this time the peas were about 6 inches high with a very even stand over the whole piece. The plants were rather light colored and no nodules could be found on the roots. On July 7th the field was again visited. The plants were found to be 12 to 15 inches high, in blossom and growing finely. The roots were examined for nodules and all the larger plants were found to be abundantly supplied with them, but very few were found upon the roots of the smaller plants and those that were found were down low on the smaller roots. As far as could be observed at this time the nodules were no more plentiful in the plots that had received the culture than on the blanks.

No rain fell during July and this field suffered greatly from the drouth, resulting in the premature ripening of the peas and a yield of less than half a crop. This experiment would not have been reported except for the interesting fact that root nodules formed abundantly on a large part of the plants on two of the four plots. It happened that one of these plots received inoculated seed and the other did not. The two other plots, one

inoculated and one not, had less root nodules. So far as known peas had never been grown on this or nearby land. The organism must have been present in the soil or else upon the seed used.

The results of these two experiments are not satisfactory because of the exceedingly sharp drouth, but they seem to indicate that most soils that have been long cultivated are well stocked with the nodule forming bacteria and that a fertilizer containing only the mineral constituents, or at the most a little added nitrate nitrogen, will supply all the needed plant food for a good crop of peas.

Sal Bordeaux for Potato Blight.

In 1904* experiments were made with dry Bordeaux mixture as a preventive of late blight that showed the dry Bordeaux to be inferior as fungicide and preventive to the wet Bordeaux mixture when applied as a fine spray. The Dust Sprayer Manufacturing Company of Kansas City, Mo., prepare a fine powder that they have named Sal Bordeaux. It consists of equal parts by weight of exceedingly finely ground copper sulphate and lime. This is applied as a dust and the theory is that as soon as this dust becomes moist, from dew or otherwise, the regular Bordeaux mixture in concentrated form is produced at once upon the foliage.

Five plots of one acre each were used in an experiment on the farm of Mr. John Watson of Houlton in comparing the effect of dusting potato vines with Sal Bordeaux and spraying with regular Bordeaux mixture. The potatoes were all Green Mountain. A high grade fertilizer (Watson's Improved) was used at the rate of 1,250 pounds per acre. The different plots were dusted and sprayed on the same days as follows, July 5, July 15, July 25, (followed by showers), August 2, August 10, and August 22.

The Sal Bordeaux was applied at the rate of 10 pounds, 6 pounds and 3 pounds per acre. It was diluted with lime in each case and until the danger of bugs was over, Paris Green was used at the rate of half a pound per acre. On July 31 all the dusted plots were also sprayed with one pound Paris Green and two pounds of lime per acre, as these plots were pretty badly infested with the potato beetle. Either the dusted poison was

* Bul. 112, Maine Agricultural Experiment Station p. 6.

not as effective as that applied wet, or the showers following the application of July 25 washed off the dusted more than it did the sprayed. Whatever the explanation, the dusted rows were infested and the sprayed rows were not.

The Sal Bordeaux was applied with a small hand "cyclone" duster, two rows being treated at a time. The nozzle of the machine was so directed that the cloud of dust striking the row nearest passed through it or was carried by the wind to the adjoining row. Of course the nearest row received the more powder and was more thoroughly dusted, but the dust was plainly visible on the second row and some reached rows beyond. With this apparatus one man could dust an acre an hour.

There was no blight on the whole piece and but little blight in the county in 1905, so that the results are not regarded as conclusive. The yields were practically the same on the 5 plots, running from 100 to 102 barrels (275 to 281 bushels) of merchantable potatoes.

It is planned to repeat the experiment in 1906 and to use a power duster devised for potatoes.

Co-operative Experiments With Alfalfa.

The Station began experimenting with alfalfa in 1903, but because of the lateness of sowing, poor preparation of soil, and other unfavorable conditions, that season's sowings gave no decisive results.

EXPERIMENTS BEGUN IN 1904.

The alfalfa seed (9,452, from Turkestan) used in 1904 was furnished by the U. S. Department of Agriculture. "This seed was secured by Mr. E. A. Bessey in the fall of 1902 at Karabulak, 25 miles north of Chimkent, Turkestan. This part of Turkestan is subject to extremely cold weather in winter and great heat in summer and the alfalfa seed raised there is considered to be the best raised in Turkestan. This seed has been treated with the alfalfa tubercles and should be in condition to give the best results."

At Princeton.

About one-half acre was sown May, 1904, on the farm of Mr. J. W. Edgerly, in Princeton. The land sloped so as to afford

good natural surface drainage. The soil was rather light, and unusually deep and yields 25 to 30 bushels of wheat to the acre. The piece was plowed in the fall of 1904, harrowed, smoothed and seeded with Turkestan alfalfa. It was planted in drills 14 inches apart so as to give the plants plenty of room, in the hope that they could be used to grow seed. Two hand seed drills were used. One of the machines was set too close so that only every other row had a good stand. The poorly seeded rows were reseeded in June. The piece was kept free from weeds by the use of the hand wheel hoe and hand work. The piece was cut once in the mid-summer of 1904. It went into the winter good shape, and came through the winter in fine condition. In 1905 this piece presented the same peculiarities found at Houlton and referred to later. In some places it was dark green in color and very vigorous, and at cutting (July 21, 1905) was 3 feet high. In other places the alfalfa plants were short and yellow. Because of the very uneven growth this experiment has been abandoned.

At Houlton.

This experiment includes two and a half acres of land on the farm of Mr. John Watson. The land slopes to the south and east, and yielded over 100 barrels of potatoes to the acre in 1903. Judging from the yield of potatoes the soil is quite uniformly productive. The whole field was fertilized with a high grade commercial fertilizer. One-half of the field was limed at the rate of one ton per acre, and one-fourth of the field was liberally dressed with hardwood ashes. The four plots were arranged so as to have lime, ashes, and no alkali on each plot. Plots 1 and 2 were seeded in May, 1904, and plots 3 and 4 in August of that year. Plots 1 and 4 were sown broadcast with a Massey seeder; plots 2 and 3 were drilled with a hand seeder in drills 14 inches apart. Plots 3 and 4 were harrowed frequently with a disc harrow up to the time of seeding in August. On the drilled part the weeds were kept down by the use of the hand wheel hoe and hand weeding. On the broadcast plots the weeds were kept down by mowing. Plot 2 was mown in July. The spring sown plots made a good growth, and went into the winter in good condition. Plots 3 and 4 were so late sown that the plants made but little growth before cold weather.

Treatment in 1905. The spring seeded broadcast plot (1) was badly choked with weeds. It is doubtful if many alfalfa plants were winter killed. Because of the weeds, the seeding of 1904 was abandoned and the plot was plowed, summer fallowed with frequent harrowing and it is planned to re-seed in 1906. The spring drilled plot (2) came through the winter without loss. The following notes were taken May 31. The plot presents very marked peculiarities. All over it are occasional plants that are very dark colored and exceedingly vigorous. These vigorous plants are the most numerous on the part treated with ashes; less numerous on that with lime; and quite scattered on the part that had neither lime nor ashes. All over the piece there are plants of sickly appearance, seemingly nitrogen starved. These, of course are most numerous on the plots that have the least of the very vigorous plants. Specimens of both the luxuriant and poor alfalfa were dug and the roots were found to be about equally stocked with root tubercles. At this date, May 31, the best plants were about 16 inches high. The poor were about 6 inches high.

The field was tested in a number of different places with litmus paper and found to be acid. As the ashes were applied with a manure spreader they would be somewhat unevenly distributed, and it might be that the places where the plants were the most vigorous received a more liberal application and that the acid was neutralized in these spots. This explanation would not apply as well to the lime which was applied by hand in finely powdered form, and would not at all explain the presence of clumps of thrifty plants on the part that had no alkali. The alfalfa was cut in July. Because of the drought in July and August the plants made but little growth until September. They went into the winter in good condition.

Plots 3 and 4 (August seeded) did not come through the winter in good shape, and the 1904 seeding was abandoned. The piece was thoroughly harrowed, smoothed and seeded May 31, 1905, with Montana grown alfalfa seed at the rate of 25 pounds per acre. This seed was applied broadcast with the Massey seeder. No fertilizer was applied this year. The eastern part of the piece, rather more than half an acre, was seeded with "scratched seed,"—i. e. seed that had been passed through a machine that scratched the seed coats, with the thought of

thus hastening germination. The remainder of the piece was seeded with unscratched seed. It germinated well, with no noticeable difference between the scratched and the unscratched seed. Because of the very dry July and August the plants made but little growth before cold weather came on.

At Fort Fairfield.

One piece of about half an acre was seeded broadcast on the farm of Mr. Clarence Powers near Maple Grove Station. This had borne potatoes the preceding season and was thought to be a very clean piece of land. It was found however to be so completely stocked with weeds that the alfalfa had very little chance. A few plants struggle through the summer, but the experiment was abandoned.

In co-operation with Dr. F. M. Perry, about one-half acre was sown near the Fort Fairfield station. This was located on the first river terrace, was light soil and naturally well drained. A liberal application of lime and of a high grade fertilizer was made. The piece was planted in drills 14 inches apart and kept free from weeds with a wheel hoe and hand weeding. A good stand was obtained, the plants grew well, were cut in July, made good second growth and went into the winter in good condition. The plants came through the winter in good shape. The stand was good and for the most part the plants were vigorous. The crop was cut in July, 1905. Because of the drouth but little second growth was made and the plants did not go into the winter of 1905-6 in as good condition as the preceding year.

EXPERIMENTS BEGUN IN 1905.

The U. S. Department of Agriculture placed at the disposal of the Station for distribution among experimenters in Maine, 500 pounds of Montana grown alfalfa seed. The following is quoted from a department letter relative to this seed. "This seed contains quite a percentage of hard seeds, i. e. seeds that will not germinate in the ordinary time and we are now considering the advisability of putting all this seed through a seed scratching machine to see if that will not improve its germinating power. * * * The Montana grown seed we propose furnishing you shows 53.5 per cent of sprouts in 3 days; probably a 7 or 8 day test will bring the germination up to 65 or 70.

At the expiration of that time there will undoubtedly be at least 25 per cent of hard seeds. This alfalfa seed has all been inoculated."

Of that sent, 400 pounds was unscratched and 100 pounds scratched. In no case did the experimenters report that there was any perceptible difference in the field germination of the scratched and the unscratched seed.

A note was put into the agricultural papers of the State that we had a limited amount of alfalfa seed that we would send to any Maine farmer applying for it on condition that the cultural instructions would be followed and results reported to the Station. A very large number of requests were received, many more than we had seed for. Seed was sent to the first 80 that applied with the following cultural suggestions.

Alfalfa—Directions for Culture.

Selection of Soil. Good deep mellow corn or potato land is usually a suitable soil for alfalfa. Good drainage is necessary, as the plants are quickly killed by excess of water in the soil or on the surface. Water must not be allowed to stand on a field of alfalfa more than forty-eight hours at a time, for if the ground becomes saturated with water and is allowed to remain so for any considerable length of time the plants will be drowned out and the roots will decay. Neither will alfalfa succeed if rock, stiff clay, or other impervious subsoil lies too near the surface. Although alfalfa requires good drainage, it also requires a fairly constant water supply and is likely to suffer from drouth on deep, sandy soil.

Preparation of the Soil. The seed is best sown in the early spring on land that was fallowed the preceding summer and left bare during the winter. The summer fallowing, if properly done, will eradicate all weed seeds that were near enough to the surface to germinate. It is well-nigh impossible to start alfalfa if the soil is not in fertile condition. The land should be put in excellent tilth and be in good heart before any attempt is made to sow alfalfa.

Sowing the Seed. The seed should be sown in early spring. For production of hay, alfalfa may be sown either broadcast or drilled. If practicable, drill the seed, as weeds can be more readily kept down. If sown broadcast, 20 pounds are used to

the acre. In drills six or seven inches apart, 15 pounds will be sufficient. This seed should not be sown with any nurse-crop, and the seed should not be drilled deeper than an inch or an inch and a half. On moist soils much less than this is better.

Inoculation for Root Tubercles. The Montana grown alfalfa seed sent herewith has been inoculated with the bacteria that produce root tubercles and enable the plant to acquire nitrogen from the air. Hence soil inoculation is not necessary.

Treatment the First Season. Drills should be cutlivated frequently enough to keep down weeds until the alfalfa has a good start. *Young alfalfa is unable to compete with weeds.* It is better for the young alfalfa to mow it frequently, setting the cutter bar rather high, the idea being to cut back the young plants, so that they will branch freely. Frequent cutting also discourages weeds. It should not be cut much later than August 15, in order to leave a good winter protection of vines.

Notes wanted. Kind of soil and previous treatment.

Date of sowing and whether in drills or broadcast.

Notes and appearance during the season.

Dates of cutting.

Length of vines when ground freezes.

The last of October (1905) blanks for reports were sent to the experimenters and replies were received from 61. Of these 61, less than half succeeded in getting a good stand. Choking out by weeds and the damage from drouth were the two most common causes of failure. Twenty-five of the experimenters report the plants as in good condition for the winter. Another season these 25 plots will be looked after and if the results are instructive, either negatively or positively, they will be reported.

NOTES AND INFERENCES.

Alfalfa growing has been tried many times in the State and while there are no alfalfa fields of any considerable size in Maine, there are a few people who have had partial success in growing the crop. At Bath there are alfalfa plants that have been established for more than ten years. The roots of a specimen sent to the Station last May were more than a half inch through at the crown. On the fine fibrous roots there were a few root nodules. A Topsham farmer has been experimenting with alfalfa for six or seven years and in a letter written last

May says: "Although the stand is not perfect by any means, I think I may claim without boasting that today I have the best plot of ¼ acre of alfalfa in Maine." There are other small pieces in Brunswick that are partial successes. Rust which has proven so destructive in Vermont and Northern New York has not been reported in Maine. Weeds are apparently the greatest menace of any one thing to successful alfalfa growing in the State. A representative of the U. S. Department of Agriculture, who has made two trips through New England studying the alalfa growing, is of the opinion that the dying out of alfalfa may "possibly be from winter killing but more probably by being run out by native grasses."

Unfortunately, as noticed on page 9 the cultures that were sent out last year for inoculating soils proved unreliable and cannot be counted upon for soil inoculation. Any one desiring to experiment with alfalfa will therefore have to grow it without inoculating the soil, or will have to obtain soil from a field where alfalfa has been grown and produced an abundance of root nodules. In order to be of value to Maine agriculture a good stand must be obtained and the stand must be able to continue not one, but several years. The Station does not advise anyone in this State to grow alfalfa at present except in an experimental way. To those who have land that seems to be suited to alfalfa and have the time and patience to thoroughly care for the crop, the Station will gladly lend assistance in any way that it can. That alfalfa would be a valuable addition to our forage crops needs no demonstration. If the difficulties which thus far have prevented its successful culture can be surmounted, it will more than recompense the cost of the many hundreds of trials that have been given this plant in Maine during the past 25 years.

Home Mixed Fertilizers For Potatoes

There are sold in Maine a large number (about 40) brands of fertilizers that contain the word "potato" in their name. In the case of more than half of these brands there seems to be no reason, other than the attractiveness of the word, to call them potato fertilizers. More than half of them have the composition of general purpose goods, carrying about 3 per cent of nitrogen, 8 per cent of phosphoric acid, and 3 per cent of potash. The same formulas could, with equal propriety, be called corn fertili-

zers. A few are seriously intended as special formulas for potatoes. These goods carry proportionately more potash and less phosphoric acid. Such brands carry from 3 to 4 per cent nitrogen, about 6 per cent available phosphoric acid and 5, 8 or even 10 or more per cent of potash.

In 1904 experiments with home mixed fertilizers in comparison with standard high grade mixed goods were made on two farms in the town of Houlton and also in Fort Farifield. The materials were bought at one time and were all mixed at Houlton. The formula was:—Portland Rendering Company's (rescreened) tankage 420 pounds; acid phosphate 400 pounds; cottonseed meal 200 pounds; sulphate of potash 200 pounds; and nitrate of soda 100 pounds. Analysis showed the mixed goods to have the following composition: Water soluble nitrogen 1.37 per cent; available nitrogen 2.72 per cent; total nitrogen 4.09 per cent; available phosphoric acid 7.01 per cent; total phosphoric acid 9.87 per cent; and potash 7.61 per cent.

The details of these experiments are given in Bulletin 112 of this Station. With the exception of one field of early planted potatoes the results were all in favor of the commercial brands.

Average yield of merchantable potatoes grown on home mixed fertilizers in 1904 *compared with commercial potato fertilizres.*

Owner of Farm.	Acres in experiment.	Barrels of Potatoes	
		Home mixed fertilizer.	Commercial fertilizer.
John Watson, Houlton	8	107	120
W. S. Blake, Houlton	8	106	110
C. A. Powers, Fort Fairfield	4	119	119
R. S. Hoyt, Fort Fairfield	6	109	114

This smaller yield was explained as follows: "The tops kept greener in color during the last half of the growing season with the home mixture. September 1, there was a severe frost all over Northern Maine. The late potatoes grown upon the home mixture had greener and more succulent vines than those upon

the standard fertilizers and in consequence were damaged much more by the frost. In fact, the vines of the late planted potatoes on the home mixed goods were practically killed at this time, while the same varieties planted at the same time upon the standard potato fertilizer continued to grow after this frost. As a result, the potatoes were larger and better ripened with these than upon the home mixed plots. For quick maturing, the home mixed goods apparently carried too much slowly available nitrogen and too little available phosphoric acid."

In 1905 three formulas were compared with one commercial potato fertilizer. The formulas used were as follows:

Home mixed formulas used for potatoes in 1905.

Ingredients.	NUMBER OF FORMULA.		
	2	3	3A
	pounds.	pounds.	pounds.
Nitrate of soda	200	100	100
Screened tankage	200	200	200
Dried blood	100	....	....
Acid phosphate	500	300	500
Sulphate of potash	200	200	200

Percentage composition of fertilizer used in 1905.

	Nitrogen.	PHOSPHORIC ACID.		Potash.
		Available.	Total.	
	%	%	%	%
Formula No. 2	4.7	6.7	8.5	8.3
Formula No. 3	3.4	6.8	9.2	12.5
Formula No. 3A	2.7	8.0	10.2	10.0
Watson's Improved	3.0	6.0	7.0	5.0

Arrangement of acre plots, pounds of fertilizer and constituents applied and yield of potatoes.

Number of plot.	Fertilizer Used. Kind.	Fertilizer Used. Amount.	Pounds per Acre in Fertilizer Used. Nitrogen.	Phosphoric Acid. Available.	Phosphoric Acid. Total.	Potash.	Yield of Potatoes. Merchantable.	Yield of Potatoes. Small.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Bbls.	Bbls.
1	Watson's Improved	1,600	48	96	112	80	101	5
2	Home mixed 2	1,200	56	80	102	100	88	6
3	Watson's Improved	1,250	37	75	87	62	71	11
4	Home mixed 3	1,000	34	70	92	125	72½	7
5	Watson's Improved	1,250	37	75	87	62	93	5½
6	Home mixed 3 A	1,000	27	80	102	100	83	2½
7	Watson's Improved	1,250	37	75	87	62	87	3
8	Home mixed 2	1,200	56	80	102	100	87	5
9	Watson's Improved	1,250	37	75	87	62	90	4½
10	Home mixed 3	1,000	34	70	92	125	89	4
11	Watson's Improved	1,250	37	75	87	62	99	4
12	Home mixed 3 A	1,000	27	80	102	100	99	4½
13	Watson's Improved	1,250	37	75	87	62	106	5

The irregularities of the yields on the first 4 plots can be explained by the differences in the character of the soil. Comparing the yields on the home mixed plots with the average of the commercial fertilizer plots either side of the home mixed plots the following results are obtained:

Formula No. 2, 87 barrels; Watson's Improved, 87 barrels.

Formula No. 3, 81 barrels ;Watson's Improved, 88 barrels.

Formula No. 3A, 91 barrels; Watson's Improved, 96 barrels.

It will be noted that the results on the whole are again lower with home mixed goods than with the commercial fertilizer. The results are not consistent, however, with each other, and no conclusive interpretation of the results is apparent. It is planned to continue the comparisons another season.

THE EFFECT OF THE RATION ON THE VALUE OF THE MANURE.

J. M. Bartlett.

In digestion experiments with steers, where both the feces and the urine were saved, potash and phosphoric acid determinations as will as nitrogen were made in order that the fertilizing value of the manure from the different rations could be compared. It will be noticed that no figures are given in the table on page 26 for the percentages of potash found in the urine. The determinations were made, but owing to a probable error in calculating the results from the dry to the fresh bases, which at this time cannot be corrected, they are omitted. Other experiments show that the potash of the food is practically all given off in the excretions, so the figures given for potash in the urine are obtained by subtracting the potash of the feces from the total amount taken in the food.

Only traces of phosphoric acid were found in the urine. In the first experiment with hay alone, more nitrogen was found in the excretions than was taken in the food. This discrepancy was probably due to insufficient nitrogen in the ration to maintain the animals and they lost flesh, excreting some body nitrogen. Therefore the feces from this ration relatively contains more nitrogen and value higher than they should, for it is evident that the animals could not continue for any length of time to give off more nitrogen than they received.

The results are given in the tables which follow:

The first table on page 26 gives the weights of food eaten and feces and urine excreted for each animal for the five days that the experiment occupied and the second table contains the percentages of fertilizing ingredients in both food and excreta.

The tables on page 27 contain the amount of fertilizing ingredients excreted by each animal and the total amount of fertilizing ingredients in the food, feces and urine, also the percentages excreted.

The total weight of food eaten, and feces and urine excreted by each steer for five days.

	Steer's number.	Hay.	Grain.	Feces.	Urine.
		Grams.	Grams.	Grams.	Grams.
Hay alone	1	18143	....	7159	16964
Hay alone	2	18143	....	7133	17372
Hay and spring wheat bran	1	15875	6804	8786	15784
Hay and spring wheat bran	2	15875	6804	8488	17826
Hay and winter wheat bran	1	15875	6804	8256	11130
Hay and winter wheat bran	2	15875	6804	8256	16919
Hay and cottonseed meal	1	18143	4536	8501	13970
Hay and cottonseed meal	2	18143	4536	8501	16645

Percentage of fertilizing material in the food, feces and urine.

	Nitrogen.		Phosphoric acid.	Potash.
Food.	%	%	%	%
Hay	0.79	....	0.33	1.49
Spring wheat bran	2.66	....	3.19	1.79
Winter wheat bran	2.58	....	2.86	1.46
Cottonseed meal	7.48	....	3.10	1.94
Feces and Urine	Feces.	Urine.	Feces.	Feces.
Hay alone .... Steer 1	1.34	0.59	0.58	0.59
Hay alone .... Steer 2	1.25	0.59	0.64	0.48
Hay and spring wheat bran .... Steer 1	1.47	0.97	2.83	1.69
Hay and spring wheat bran .... Steer 2	1.51	0.86	2.49	1.17
Hay and winter wheat bran .... Steer 1	1.45	1.16	2.32	1.74
Hay and winter wheat bran .... Steer 2	1.48	0.75	2.26	1.29
Hay and cottonseed .... Steer 1	1.80	1.87	1.94	0.98
Hay and cottonseed .... Steer 2	1.81	1.48	1.57	1.04

Fertilizing elements excreted by each steer for five days

	Nitrogen. Solid.	Nitrogen. Urine.	Phosphoric acid—solid.	Potash. Solid.	Potash. Urine.
	Grams.	Grams.	Grams.	Grams.	Grams.
Hay alone......................Steer 1	95.9	100 1	41.5	42.2	228.1
Hay alone......................Steer 2	89.2	102.5	45.6	34.2	236.1
Hay and spring wheat bran, Steer 1	129.1	153.1	248.6	148.5	209.9
Hay and spring wheat bran, Steer 2	128.2	153.3	211.3	99.3	259 1
Hay and winter wheat bran, Steer 1	119.7	129.1	191.5	143.7	192.2
Hay and winter wheat bran, Steer 2	122.2	126.9	186.6	106.5	229.4
Hay and cottonseed meal....Steer 1	153.0	261.3	164.9	83.3	275.0
Hay and cottonseed meal....Steer 2	154.6	246.5	134.1	88.8	269.5

Fertilizing elements in food and the average amount excreted for each experiment. Five days.

	Amount in Food. Nitrogen.	Amount in Food. Phos. acid.	Amount in Food. Potash.	Amount Excreted. Nitrogen.	Amount Excreted. Phos. acid.	Amount Excreted. Potash.	Per Cent Excreted. Nitrogen.	Per Cent Excreted. Phos. acid.
	Gms.	Gms.	Gms.	Gms.	Gms.	Gms.	%	%
Hay alone.	143.3	59.9	270.3	193.9	43.6	270 3	135.3	71.8
Hay and spring wheat bran.........	306.4	269.6	358.4	276.4	229.2	358.4	89.2	85.3
Hay and winter wheat bran.........	300.9	243.3	335.9	254.0	189.1	335.9	84.4	77.7
Hay and cottonseed meal, 8 to 2....	482.6	200.5	358.3	407.7	149.5	358.3	84.7	74.6

In the table that follows there are given the values of the fertilizing constituents of the total excreta in each experiment and of the resulting manure from 100 pounds of each feed, provided both the solid and liquid excreta are saved. In the calculations the values for the same materials assumed for commercial fertilizers in 1904 are used.

The money value of the fertilizing elements excreted for each experiment.

	Nitrogen.	Phosphoric acid.	Potash.	Total value.
	Cents.	Cents.	Cents.	Cents.
Hay alone	5.36	.39	2.98	8.63
Hay and spring wheat bran	10.40	2.03	3.95	16.38
Hay and winter wheat bran	9.52	1.67	3.70	14.89
Hay and cottonseed meal	15.30	1.32	3.95	20.57
100 lbs. hay	13.50	.98	7.45	21.93
100 lbs. spring wheat bran	37.80	11.91	8.93	58.64
100 lbs. winter wheat bran	31.90	8.85	7.27	48.02
100 lbs. cottonseed meal	99.40	9.30	9.60	118.30

The figures given in the above tables furnish results which are instructive and may be of considerable value to the farmer. In feeding animals or buying feeds, one is very likely to consider only the feeding or flesh forming value of the feeds, not taking into consideration their effect on the value of the manure produced. When more manure is needed than can be made and the supply has to be frequently supplemented with commercial fertilizers, the purchase of high priced feeds rich in fertilizing material is oftentimes the most economical on account of the increased value of the manure they make. In the preceding table it will be seen that for every 100 pounds of cottonseed meal fed, about $1.18 worth of fertilizing material was given off in the excreta when everything is saved.

Another important fact can be learned from the table on page 27 which shows the amount of fertilizing elements in both the solid and liquid excrements. It will be noticed that the larger part of the nitrogen, the most expensive element, and potash are given off in the urine, hence the importance of saving all of this most valuable part of the manure. Not only are other elements found in large quantities in the liquid, but they are in much more available form than in the solid.

ORCHARD NOTES.

W. M. Munson.

The fact that the apple grows in many parts of the State as though it were indigenous and that orchards will exist and bear a partial crop of fruit though seriously neglected, is responsible for much of the ill-treatment so common to the orchards of Maine. There is little doubt, however, that a well managed orchard is a most valuable farm property, and one of the surest sources of income. For many years the Experiment Station has devoted a large amount of attention to the orchard industry, as evidenced by its publications on this important subject. It is the purpose of the present bulletin to report recent observations and experiments upon successful orchard management.

Notes on Spraying.

"Watch and spray," as well as "cultivate and feed," must be the motto of the successful orchardist. The importance of watchfulness, and the direct value of spraying, as a means of holding in check insect and fungous enemies of the orchard, have been repeatedly urged by this Experiment Station* and in so far as suggestions made have been followed, the results obtained by the fruit-growers of the State have been satisfactory.

By the work of this Station it has been shown beyond doubt that, by spraying at the proper time, and in the proper manner, the canker worm, tent caterpillar and forest caterpillar may be held in check; that the "apple worm" or codling moth may be controlled; that scale insects may be destroyed; that the green aphis or plant louse may be killed; that apple scab, cracking of pears, and rotting of plums may be very greatly reduced;—and still spraying is not a common practice among the fruit-growers of Maine!

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* Repts. Maine Expt. Sta. 1891, 1892, 1893, 1894; Buls. 8, 52, 56.

With the great orchardists of New York, Michigan and the Pacific slope, spraying is just as much a part of the regular work of fruit growing as is pruning, or even harvesting. No live orchardist of California or Oregon would think of omitting the five or six treatments with Bordeaux mixture and Paris green, or with kerosene emulsion or resin wash, as the case might demand, any more than he would omit frequent cultivation or irrigation. It is because of this thoroughness in the production of fruit, as well as in grading and packing, that the fruit growers of the northwest are able to send their fruit across the continent and so nearly control the local eastern markets.

REASON FOR SPRAYING.

The leaves of plants have two functions essential to life and health. They act, in a measure, as both lungs and stomach for the plant. Consequently if they are destroyed or diseased, the whole plant suffers; the crop of fruit is lessened; and the vitality of the plant is weakened. It is for this reason that spraying is of importance, even in those seasons when there is no fruit. Spraying is an insurance and not a remedy, and there should be a definite purpose in view for every application. Specific directions for controlling the leading insect and fungous enemies of the orchard are given in "How to Fight Apple Enemies," published by this Experiment Station and sent free to any one requesting it.

RESULTS OF SPRAYING.

In a recent canvas of the orchards of Wayne and Orleans counties, New York, by Dr. George F. Warren,* it was found that in Wayne county, of 66 sprayed orchards, representing 626 acres, the yield in 1903 was at the rate of 280 bushels per acre; while 107 unsprayed orchards, covering 673 acres, yielded at the rate of 253 bushels per acre. For the sprayed fruit the average price per barrel was $2.02; while for the unsprayed fruit the price was but $1.80.

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* Bul. 226, 227, Cornell Univ. Expt. Sta.

Figure 1.
The menace of the caterpillar.—Trees not sprayed.
See page 32.

Figure 2.
The menace of the caterpillar.—Result of spraying with arsenical poisons.—See page 32.

Of 179 orchards canvassed in Orleans county the following report was made:

Yields and incomes from orchards sprayed different numbers of times.

How treated.	Yields.			Portion of crop barreled.	Incomes.		
	Number of orchards.	Number of acres.	Average yield per acre.		Number of orchards.	Number of acres.	Average income per acre.
Unsprayed	43	381.0	328	66	54	449.5	$103
Sprayed once	33	352.0	346	74	30	316.0	139
Sprayed twice	70	701.0	374	78	64	644.0	143
Sprayed three times	27	247.5	414	87	25	236.5	184
Sprayed four times	6	43.0	569	77	6	43.0	211

The significance of the figures given is so obvious that comment is unnecessary, except that they corroborate in full the experience of those who have practiced similar treatment in this State.

THE MENACE OF THE CATERPILLAR.

The approach of the gipsy-moth and the brown-tail, has stirred the people of Maine to such an extent as to insure active steps for the control of these pests. Every year, however, trees are defoliated by canker worm, forest caterpillar, tent caterpillar, and similar enemies, with little attempt on the part of growers to protect themselves from damage.

It is well understood that the forest caterpillar appears in destructive numbers at more or less irregular intervals; only to disappear again, after ruining many orchards, and defoliating hundreds of thousands of forest trees. This disappearance is caused by the rapid increase of natural parasites. With the destruction of the caterpillars, the parasites die, and so there is an alternation in the period when there are many and when there are few of these pests.

The last serious invasion of the forest caterpillar was in 1897 and 1898, when whole orchards were swept as if by fire for two successive seasons. The results were naturally disastrous. It is now nearly time for a return of this caterpillar and the enterprising orchardist will be ready to meet it.

That the pest may be held in check was plainly demonstrated by the work of the Station during the last invasion. A large orchard of Baldwins which was sprayed with Paris green when the caterpillars first appeared and twice afterwards, was almost free from injury, while adjoining trees, not sprayed, were completely defoliated, and never recovered from the injury. The accompanying cuts represent the condition of the two orchards late in June.

Similar results have repeatedly been obtained in fighting the canker worm. It is highly important, however, that, for either of these pests, spraying be done just as soon as the leaves begin to unfold, and again in about a week or ten days. After the larvæ become half grown, spraying is not always effective.

Another precautionary measure to be borne in mind, in dealing with the forest caterpillar, is to prevent migration from tree to tree, and from forest trees to the orchard trees. This may be effected by placing a band of tarred paper about the trunk of the tree and smearing this with a thick coating of equal parts of lard and sulphur. It is very important that this mixture be not placed directly on the bark of the tree, as injury almost invariably results.

The method here noted was used with remarkable success in the orchards above mentioned. The caterpillars gathered by the hundred beneath the band, but would not cross the line, and were readily disposed of by means of a swab dipped in a very strong solution of washing powder. The masses of caterpillars upon the limbs were destroyed in the same way; those that escaped by dropping to the ground being stopped by the bands, and then killed as above.

OYSTER-SHELL BARK LOUSE.

An insect which is nearly as destructive as the dreaded San Jose scale, is annually doing thousands of dollars worth of damage in the State without the slightest notice on the part of farmer or fruit grower. This insect—the oyster-shell bark louse—is so familiar, and yet so inconspicuous, that it is usually overlooked. The insect is fully described in Bulletin 56 of this Station, to which the reader is referred. It frequently is the unsuspected cause of the stunted, sickly appearance of certain trees to be found in almost every orchard. The mature form, shown in

figure 7, may very readily be seen where the foliage is off. Every young orchard should be examined early in the spring and, if found infested, should be thoroughly treated with caustic soda or some other strong alkali.

The eggs of this insect hatch in June, or early in July, and the little lice travel rapidly over the surface of the young wood and the fruit until they find a satisfactory feeding ground, when they insert their beaks and begin their campaign against the life of the tree. Figure 6 shows the young lice, natural size, early in July.

Spraying the trees thoroughly with kerosene emulsion when the lice are in the migratory stage, as described in "How to Fight Apple Enemies," has in every instance, at the Station, been effective in controlling this pest.

APPLE SCAB.

Another ever present, and very generally neglected, pest of the orchard is the fungus disease, apple scab, or "black spot" as it is sometimes called. This disease, figure 3, has been so frequently described as to be perfectly familiar. As shown in former reports of this Station,* spraying is effective in securing a crop of fruit relatively free from this disease, even in those seasons when the scab is most prevalent.

For several years the conditions in most parts of Maine have been such that the fruit has been relatively free from scab, and as a result many growers who took up the practice of spraying some years ago, have gradually ceased to spray. It should be said, however, that this neglect is wholly comparable to the neglect which permits the lapse of a fire insurance policy. It may be unnecessary to spray to secure a crop of fair fruit one year, or even two or three years in succession; but when the unfavorable season does come, if spraying has been neglected, there is frequently a needless loss of several hundred barrels of fruit in orchards of average size.

As a result of the studies above mentioned † the fact was clearly demonstrated that, in a bad season, there was a difference of 50 per cent in the amount of perfect fruit upon sprayed and unsprayed trees; the best results being obtained from the use

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* Ann. Rpt. Maine Expt. Sta. 1891, 1892, 1893, 1894

† See details and summary, Rpt. Maine Expt. Sta., 1893, 125-128.

of Bordeaux mixture. In other words, trees not sprayed gave on three successive years .1, .9, and 38.2 per cent of the fruit free from scab, while the same years an equal number of trees sprayed with eau celeste (copper sulphate, carbonate of soda and ammonia) gave 58.8, 30.1 and 72.8 per cent respectively. The third year Bordeaux mixture was used and gave still better results—79.9 per cent of the fruit being free from scab.

From these, and similar results obtained all over the country, it is evident that spraying has ceased to be an experiment as a means of controlling certain orchard diseases. The results above cited have been repeatedly confirmed both at this Station and elsewhere. Reference is made to the subject at this time only to emphasize the importance of using precautionary measures. Even though there be no crop of fruit, the increased vigor of the trees as a result of clean healthy foliage, will far more than repay the cost of spraying. This spraying with Bordeaux mixture should be done first before the buds burst, and again immediately after the blossoms fall, if but two treatments are to be given. If the season is very wet, however, at least four treatments at intervals of two or three weeks are found to be advantageous.

PINK ROT.

In 1902 a comparatively new fungous disease made its appearance to a very destructive extent in western New York. This disease, known as "Pink Rot," because of its pinkish, mildew-like appearance, had long been known to botanists but only, or mainly, as a saprophyte, or fungus which grows on dead or decaying matter. It did not come under the writer's personal observation until the present season; although said to have been destructive to stored apples in Maine in 1902.

The appearance of this trouble is well shown in figure 4, from a photograph of fameuse apples grown at the Station the past year. The best description of the trouble, with a full account of its life history, is given by Eustace in Bulletin 227 of the New York Agricultural Experiment Station.

The disease attacks the fruit on the scab spots, where it appears like a pinkish mildew. Later in the season, the spots become brown, sunken and rotten. If badly attacked the whole fruit soon decays. Because of its appearance only on the scab spots, many have regarded it as simply another form of the

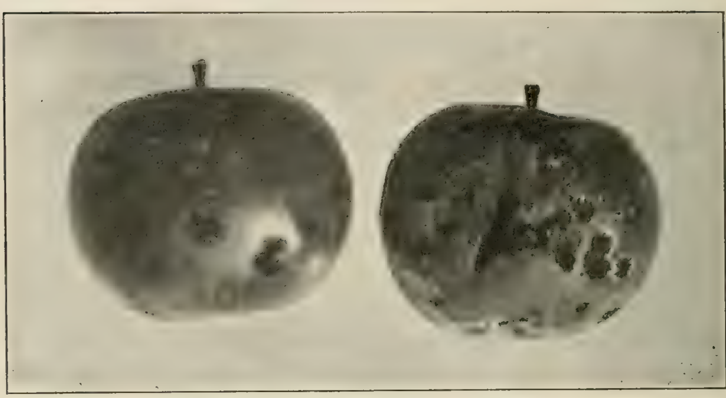

Figure 3. Apple Scab. See page 34.

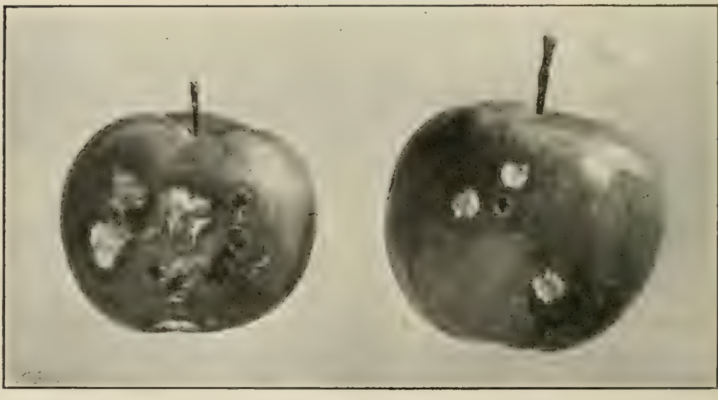

Figure 4. Pink Rot. See page 35.

apple scab. Others have referred to it as a parasite on the scab fungus. Eustace maintains, however, that "there is absolutely no connection between the two. The only part that the scab had in the matter was that it ruptured the epidermis (skin) of the apple, thus making an entrance for this fungus to grow into the tissue and cause the rot."

A distinctive characteristic of this disease is that the decayed spots are rather dry and corky, and not very deep. Apples thus affected might, in some cases, be used for evaporating, as the diseased portion could be removed in paring; but because of the bitter character of the rot, affected fruit would be worthless for cider.

The disease is specially destructive to stored fruit, the "sweating" of the fruit furnishing just the right conditions for its rapid development. Eustace reports that: "It was noticeable that the fruit in the bottom of large bins, such as are used about cider mills and drying houses, would become one mass of decay if allowed to remain there longer than a few days."* It was in stored fruit that the loss before mentioned occurred in Maine.

As is well known, the "scab" is ever with us, and growers have become accustomed to its disfiguring presence; but with the advent of this destructive secondary enemy, the importance of warding off the attack of both becomes imperative. Thorough spraying with Bordeaux mixture is the only safe means of preventing this trouble.

Effect of an Unbalanced Ration.

In 1904 an obscure disease affected the fruit of certain trees in the orchard of Mr. Chas. S. Pope, Manchester. No similar trouble had ever come under the notice of the writer and this note is made simply as a matter of record. A careful study of the cause of the condition described is being carried on at the present time.

In August, when about the size of walnuts, the fruits began to crack and to drop. Marked indentations, somewhat similar to those made by curculio, were abundant. No evidence of insect work could be discovered, however. When the fruit was opened, the tissue under the indented parts was found to be dry

* Bul. 227, N. Y. Expt. Sta., 373.

and brown. Most of the fruit ceased to grow, and by the first of September the larger part of it was on the ground; though early in the season all the trees were well loaded. The leaves, however, appeared perfectly healthy.

At the time of harvesting, October 10, most of the trees had lost all of their fruit. Such as remained on some of the trees was, for the most part, small and deformed. Some of the fruit, however, was of medium size with one side cracked as in figure 5, and a small portion was without marked blemish. In all cases, however, the texture of the fruit was soft and spongy,—about as might be expected in April or May. The surface of the fruits was also characteristic, there being numerous minute elevations or "pimples," corresponding to the grayish dots on the fruit. This feature is shown in figure 5, and was so noticeable that the workmen spoke of it in handling the fruit after removal to the cellar. Though a small portion of the fruit was on the trees at harvest time, it dropped so easily that no attempt was made to save it for packing. The slightest jarring of the limbs would cause it to fall.

The reason for the condition above indicated is, as already noted, very obscure. A careful microscopic examination was made without finding evidence of any fungous enemy, even in the brown dry tissue above mentioned. It was then observed that the condition existed only with certain trees included in a fertilizer experiment in which an excess of available nitrogen is applied every year. The first tree noticed was in the plat receiving nitrate of soda and acid phosphate, and later it was found that every tree on this plat, as also on the adjoining plat which received nitrate only, was affected as described. In one or two instances check trees which adjoined the nitrate plat, and received no direct application of fertilizer, showed a tendency in this direction. None of the other trees in the whole orchard, however, gave the least indication of the trouble. A fertilizer plat on which were muriate of potash and acid phosphate, and another on which was muriate only, separated from the first by only a single row of trees, were entirely free from the disease.

The supposition was therefore made that the trouble was physiological and due to the excessive amount of available nitrogen and the lack of potash. Of course this is a matter of conjecture and can be settled only by definite and careful experiment.

Figure 5. The effect of an unbalanced ration (?) See page 37.

In partial support of the supposition adopted, is the report of Mr. P. L. Ricker of the U. S. Department of Agriculture to whom specimens of fruit and leaves were sent. Knowing nothing of the conditions under which the trees were growing, Mr. Ricker reports:* "I can make out no signs of any fungus mycelium in the apple. There is a little ordinary mould around one of the holes in the apple, but not in condition to determine. It is not connected with the disease of the apple—if it can be so called. The main trouble seems to be from the bites of curculio. * * * The apples have been in a moist chamber ever since they came but no fungus has developed yet. There is a little core rot in some of them, the cause of which is not definitely known, but it is physiological and supposed to be due to some trouble in nutrition, or perhaps some root trouble. This, however, can only be determined by examining the roots and the conditions under which the tree was growing. There are none of the fungous diseases on the leaves, either. * * * Of course none of the physiological diseases can be determined from samples of the plants sent. A careful study of them in their natural surroundings is necessary, with, perhaps, experiments looking towards the improvement of soil conditions."

The outcome of a further study of this problem may be of much interest and some importance in connection with the rational fertilization of orchards.

Winter Injuries to Trees.

The injuries to trees during winter, in Maine, are usually due to the freezing of buds or young wood, and to girdling by mice. Both classes of injury have been emphasized by the severe winters of the past two or three years.

FREEZING.

The winters of 1903-4 and of 1904-5 were exceptionally severe in Maine, and as a result many complaints were made that the apple orchards had suffered more than for the previous twenty years. An explanation of this condition is not difficult; and a partial remedy is easily applied. More important than a remedy, however, is an awakening to the need of using measures which will prevent a recurrence of the trouble in the future.

* Personal letter to the writer Oct. 21, 1904.

There is little doubt that, to a large extent, the injury noted was due to the full crop of fruit borne in 1904, immediately following a trying season, and succeeded by a particularly severe winter. In the early part of the season of 1903, there was a very slight rainfall. This drought was followed late in the season by excessive rains which caused a full development of fruit buds and late growth of wood. Though the trees did not appear to suffer much after the trying winter which followed, they were doubtless considerably weakened, and the heavy loads of fruit borne in the next season left them in an exhausted condition before the second severe winter came on. From the first, the winter of 1904-5 was trying. In December there were twenty-six mornings when the mercury went to zero or below, and several times during the winter 20° to 30° below zero were reached. As a (probable) result of these conditions, the trees suffered as indicated. In almost every case coming under the writer's observation, the trees which suffered most were those which bore a full crop the previous year.

The injury was manifested by the killing of the smaller limbs, and in many cases by the death of the whole tree. The central portions of the tops of many Gravenstein trees were ruined. Many Baldwin tops were thinned. So far as observed, however, there was not a marked difference in the destruction of nursery grown Baldwins as compared with those top-worked on seedling stocks; although it is commonly supposed that the trunk of the Baldwin is tender.*

Trees which had been well cultivated and fertilized, if allowed to overbear were, in many cases, ruined. One Baldwin tree which bore 8½ barrels of fruit in 1904 (see figure 10, Bul. 122) was practically ruined. There is little doubt that had one-half of the fruit been removed from such trees early in the summer, less trouble would have been experienced.

In neglected orchards, or in many cases where good thrifty orchards were left in sod, the injured trees continued to deteriorate, and many died later in the season. In those cases where

* In Bulletin 269, N. Y. Expt. Sta., page 336, Eustace reports that in 1903 young nursery trees of Baldwin are very susceptible to injury by cold; and Baldwin and Gravenstein are reported as injured most by some New York growers.

Mr. F. H. Morse of Oxford County, Me., reports injury to the Baldwin trunks in winter of 1904-5.

the land was plowed and fertilized, however, the trees started a new growth of vigorous shoots near the base of the main limbs, and it will be possible to build a new top on such.

Those orchards which were not pruned last spring should be treated *at once;* all dead wood being removed and injured branches being shortened, to give the new wood a chance to develop. In many cases, too, if a vigorous growth was made last season, cions may be set which will aid in re-forming a good top.

To prevent future injury in this way, avoid allowing the trees to be overloaded with fruit. The fact that as many barrels of fruit may be secured, with much less strain on the vitality of the trees, as a result of systematic thinning, has been fully demonstrated; and the price received for such thinned fruit will usually be enough higher to pay cost of labor. In fact the fruit must be harvested at some time, and it is wiser to remove wormy and deformed fruit in August, rather than in October.

Proper cultivation and feeding will go far toward putting trees in condition to withstand a severe winter; but in no case should cultivation be continued later than August 1st to 10th. A cover crop of some kind sown at the time of last cultivation will often aid in checking late growth of trees.

Young trees which fail to mature their wood before cold weather, frequently suffer. Such trees should have the young wood pinched back about the time of the first frost,—about the middle of September at Orono; two weeks later in the southern part of the State.

MICE.

More complaint as to winter injury by mice was heard during the past season, than since 1891. Whole orchards of bearing age were ruined. The attention of the writer was called to trees ten inches in diameter which were almost completely girdled. This condition was of course due to the very severe winter with the prevailing deep snows from early December till late in March. While so much trouble may not be experienced again for some years, it is liable to occur at any time; and the careful orchardist will not only repair past injuries but, as far as possible, prevent future ones.

Any ordinary case of girdling by mice may easily be repaired by "bridge grafting." This consists simply in trimming the

edges of the mangled bark back to where it is firm and healthy, and inserting cions at intervals of an inch or two around the girdled portion. This is done by raising the bark, both above and below the girdle, with the point of a knife, and putting under it the end of a cion which has previously been made wedge shaped at each end. The cion must be fresh, vigorous, young wood and may be of the same tree, or of any other variety. When finished the work will be as indicated in figure 8.

To prevent drying of the wood, and of the edges of the bark before the cions unite, it is well to cover the injured part with a plastic made of clay and cow dung, and cover the whole with a piece of burlap,—as an old fertilizer sack.

A tree nearly a foot in diameter was treated by the writer as described last spring, and every cion united and made a good growth during the summer.

Figure 9 shows a pear tree about thirty years old that was bridge grafted when young. It is now more than a foot in diameter and bears well every year.

Better than repair, however, is the prevention of injury to a young orchard. This may easily be accomplished by the use of some protective covering at the base of the tree. The most common materials used are wire screen, tarred paper, and wood veneer.

The protectors should be about two feet high, otherwise they are not always effective. They should also be pressed into the ground so that mice cannot crawl under. The first cost of the wire screen is greater than that of the others, but as it lasts several years, and requires no attention after the first putting on the cost is more than balanced by reduced amount of labor.

The practice at the Station has been to get a roll of 3-foot wire cloth and cut it into strips two feet long. These strips would then make four protectors, each nine inches wide. There is an advantage in using 2-foot wire, if available, because of the selvage ends, and the reduced amount of cutting required. These strips are put loosely about the tree and held in place with small annealed wire at top, middle, and bottom.

The strips of tarred paper are put on in the same way as the wire cloth, and usually held in place with pieces of twine. It is very important, however, that the paper be removed in the spring, as otherwise the trees are in danger of scalding. The material for protecting 400 young trees with wire last year, cost

Figure 6.
Oyster-shell bark-louse,—just hatched.
See page 34.

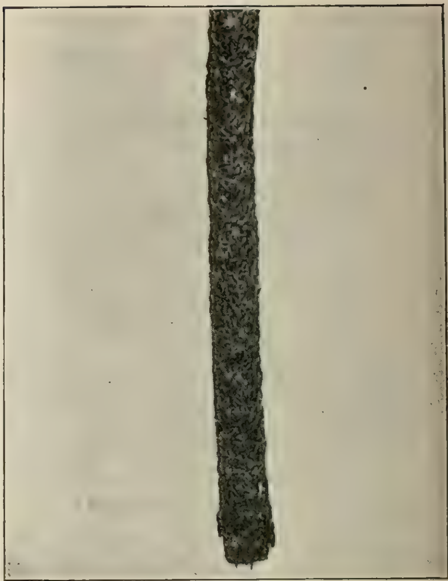

Figure 7.
Oyster-shell bark-louse,—mature form.
See page 34.

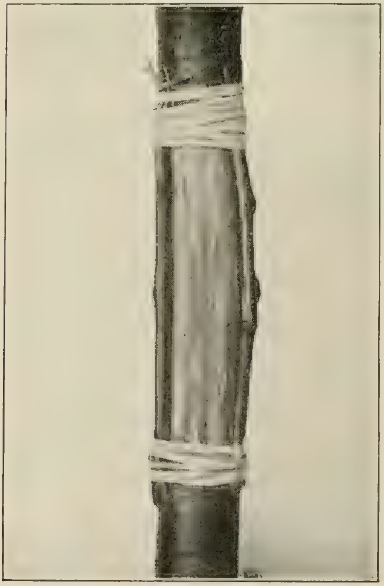

Figure 8.
Bridge-grafting of a girdled tree.
See page 43.

Figure 9.
Saved by bridge-grafting.
See page 43.

$7.50. Tarred paper for an equal number cost 84 cents,—refuse binding twine being used as tying material. The time required for applying was about the same in each case. Next spring, however, the paper must be removed, only to be renewed the following winter, while no further attention need be given the wire.

Strips of wood veneer, costing $5.00 per thousand, are largely used in the western states. About 200 of them were used in comparison with the other materials named. Very little time is required for applying them, as no tying is needed, but the work must be done before freezing weather comes, or many of them will crack and be worthless.

Another protective measure which has been used with satisfactory results is the tramping of the snow about the bases of the trees after a heavy storm. This makes a wall of ice which serves as a barrier. If, after tramping, a covering or mulch of stable manure is applied, there is less probability that further tramping will be needed.

Still another, and cheaper, method of protection, is to apply a coat of paint to the tree. Many fear the effect of the paint, but if pure materials are used no ill effect appears to follow. On nursery trees at the Station, white lead, zinc white, and a special preparation, "Tanglefoot," have been used. While it cannot definitely be said that any of these keep the mice away—since none of the other trees in the nursery have suffered—no injury to the trees has in any case resulted.

Suggestions as to Handling Fruit.

Just when and how to pick fruit depends largely upon the kind of fruit, the distance it must be shipped, and the demands of the market supplied. If one is delivering fruit directly to the consumer, and catering to a so-called "fancy market," he must see that the produce is in the very finest dessert condition, and fully ripe before picking. Consumers of such fruit are always willing to pay an extra price for the advantage of having it in the highest state of perfection.

The process of ripening is incipient breaking down of plant tissue, and there is no well marked distinction between "greenness," "ripeness" and "decay." One stage passes into the other insensibly, and it may be seen that the riper the fruit the sooner

the breaking down of the tissues (in other words decay) may be expected. Fruits that are picked when very green or immature will not break down so quickly as those that are farther advanced. As a rule, however, such fruits never reach the most edible stage, and they frequently shrivel and become unmarketable. Many of the peaches brought into the markets of Maine are, because of too early picking, totally unfit for use, but we eat them,—and some call them good. Some of the winter apples, like Roxbury Russet, and Ben Davis, if harvested too early, will shrivel and become practically worthless before spring.

The precise stage at which fruit may be most advantageously harvested is a matter which each grower must decide for himself, in accordance with the conditions of his market. Some successful orchardists depend upon Williams' Favorite as their chief market apple, allowing the fruit to ripen on the tree and marketing only choice dessert specimens. Naturally such a course would be possible only when there is a good local market.

It may be superfluous to suggest how to pick fruit. Nevertheless this is one of the most important factors in the successful handling of the product. The hiring of cheap laborers for picking is of doubtful economy, although for many kinds of work such laborers, who will do as told, are valuable help, even though not familiar with the details of the business. In general, however, the picker should understand the importance of his work, and should bear in mind the fact that every evidence of handling detracts from the market value of the fruit. There is a general notion that any one can pick apples, but such is not the case; and every year large amounts of fruit are lost and many trees permanently injured by careless or ignorant pickers. During the past season some of the Tolmans and Alexanders in the Station orchards were rendered almost unsaleable because the pickers grasped the fruit so firmly as to leave an imprint of every finger on the apple.

It is, perhaps, unnecessary to urge that usually the apple is not ready for harvest until it will part readily from the fruit spur. The fruit should never be pressed with thumb and fingers, or thrown into a basket or bag. All fruit should be handled as carefully as would be necessary with eggs.

During the last apple harvest, in spite of the high price of fruit, the writer saw a prominent farmer carefully hand pick his

Baldwins and Greenings and then pour them into fertilizer sacks to carry to the cellar. Nor, strange to say, is this unusual with many farmers who grow a few apples as a side issue. Almost every day, otherwise good fruit is brought to market in this careless manner. It is frequently the man who handles fruit in this way who complains that fruit growing is not a profitable feature of his farm work.

Pears are frequently injured by being left on the trees too long. These should be gathered just as soon as they will part from the tree readily, and should be ripened in a cool, dark place. In the case of winter pears, the usual guide for harvesting is the time when the pears begin to drop.

Suggestions on Pruning.

Intelligent pruning at the right time is absolutely essential to the production of the best fruit. An unpruned tree may, in many instances, produce a larger number of apples than an adjacent pruned tree; but the percentage of merchantable fruit will invariably be smaller. Small apples contain just as many seeds as large ones, and therefore make practically as great demands on the store of plant food. They do not, however, fill the basket, nor the pocketbook, so rapidly as the others.

The amount of pruning necessary depends largely upon the location and exposure of the orchard. Trees on a warm, southern slope, freely exposed to the winds, require much less pruning than do those in a cool, sheltered location which is lacking in sunshine. Plenty of light is essential to the production of highly colored fruit. It is desirable that trees should be pruned intelligently from the time they are set, but old trees may often be given a new lease of life by judicious management. If the trees have been long neglected and require heavy pruning, do not remove all of the wood the first year. Removal of a portion of the top, thus distributing the food gathered by the roots to a smaller number of branches, tends to produce rapid growth and a renewed vigor of the tree. The removal of too much at one time, will start the growth of water-sprouts and defeat the very purpose in view.

The best time for pruning is on warm days from January to May. More can be accomplished in the longer days of March, April and May, but many prefer to go through the orchard on

the crust of a deep snow. The time of year when the cut is made has little effect on the readiness with which the wound heals, but more care is necessary to prevent injury to trees pruned when the wood is frozen.

A wound made by removing a limb heals best if the cut is made close to the trunk or branch. A stub two or three inches long does not heal, and becomes a lodging place for spores of fungi and bacteria which cause decay and death of the tree. The splitting down of large limbs may often be avoided when pruning, by sawing in from the under side first; but in every case, see that the wound is left clean and smooth. Wounds should also be covered immediately with a coat of paint, shellac, or grafting wax to keep out the moisture and the spores before mentioned.

POULTRY EXPERIMENTS, 1905-6.

G. M. Gowell.

[The poultry work of the Experiment Station was undertaken primarily to study breeding for egg production and has been in progress for several years. Two years ago the Bureau of Animal Industry of the U. S. Department of Agriculture desired to cooperate in the work and is now contributing $1,000 per year to assist in the carrying forward of the breeding experiments. Considerable unpublished data from these experiments have accumulated, but it has been decided to hold this matter for another year before it is published, at which time it will probably be issued as a bulletin of the Bureau of Animal Industry.

The following papers on poultry experiments have been published. These are no longer available for distribution. A summary bulletin bringing the work up to date has been prepared for the Bureau of Animal Industry and will be shortly issued by the U. S. Department of Agriculture. This can be obtained by addressing the Secretary of Agriculture, Washington, D. C.

Number of Laying Hens that can be profitably kept in one Pen, Annual Report for 1898.

Feeding Chickens for Growth, Bulletin 64.

Breeding for Egg Production, Bulletin 64.

Feeding Chickens for Growth, Bulletin 79.

Experiments in Incubation, Bulletin 79.

Breeding for Egg Production, Bulletin 79.

Breeding for Egg Production, Bulletin 93.

Floor Space, etc., in relation to Egg Production, Bulletin 93.

Poultry Management as practiced at the Maine Station, Bulletin 100.

Poultry Experiments, 1903-5, Bulletin 117.

This bulletin (130) in addition to containing accounts of experimental work, supplements bulletins 100 and 117 by outlining the methods of housing and handling the stock that have been adopted since these bulletins were issued.—C. D. W.]

The Incubator House and Poultryman's Residence.

Last fall the Station constructed an incubator cellar with a residence for the poultryman above it. The building is located conveniently near the poultry buildings and runs, and yet sufficiently removed to make it desirable as a residence.

Living so handy enables the poultryman to be in close touch with his work during the incubating and brooding season. While the incubators are in operation he inspects them at 5 o'clock in the morning and between 8 and 9 P. M. During the breeding period and while the chickens are on the range, it is desirable to have them liberated and fed as soon as they can see to eat in the morning, and not shut in at night until just before dark. This makes a long day for the caretaker, and the handy location of this house enables him to do his work more easily and satisfactorily.

The incubator cellar is 30 feet square, inside measurements, and 7 feet in the clear. Its walls are of concrete material and the floor is cemented. Two large cellar windows are in each of the west, north and east sides, but none on the south, as the warmth of the sun, admitted by windows in that side, would be liable to raise the temperature of the cellar during the middle of the day. The six windows give good light for caring for incubators and handling the eggs. Broad shutters darken the room when the eggs are being tested. The building has two chimneys and each has two separate flues. One flue in each chimney connects with the house fires and the other ventilates the cellar through adjustable openings. The chimneys being warmed by the up-stair fires cause the ventilating shutes to draw and ventilate the cellar quite well. In addition to these ventilators, the double doors in the rollway have openings 10 inches square with adjustable slides, and when necessary they are used to give complete ventilation. In the mornings, when the lamps are being cleaned and trimmed, and the out-of-door temperature is normal, both of the rollway doors are left partially open so as to quickly remove the odors of the lamps.

Thorough ventilation and a full supply of clean air to the incubator cellar are imperative. The incubator room is large enough to accommodate 16 of the largest size Cyphers incubators and leave space for passages between the machines for

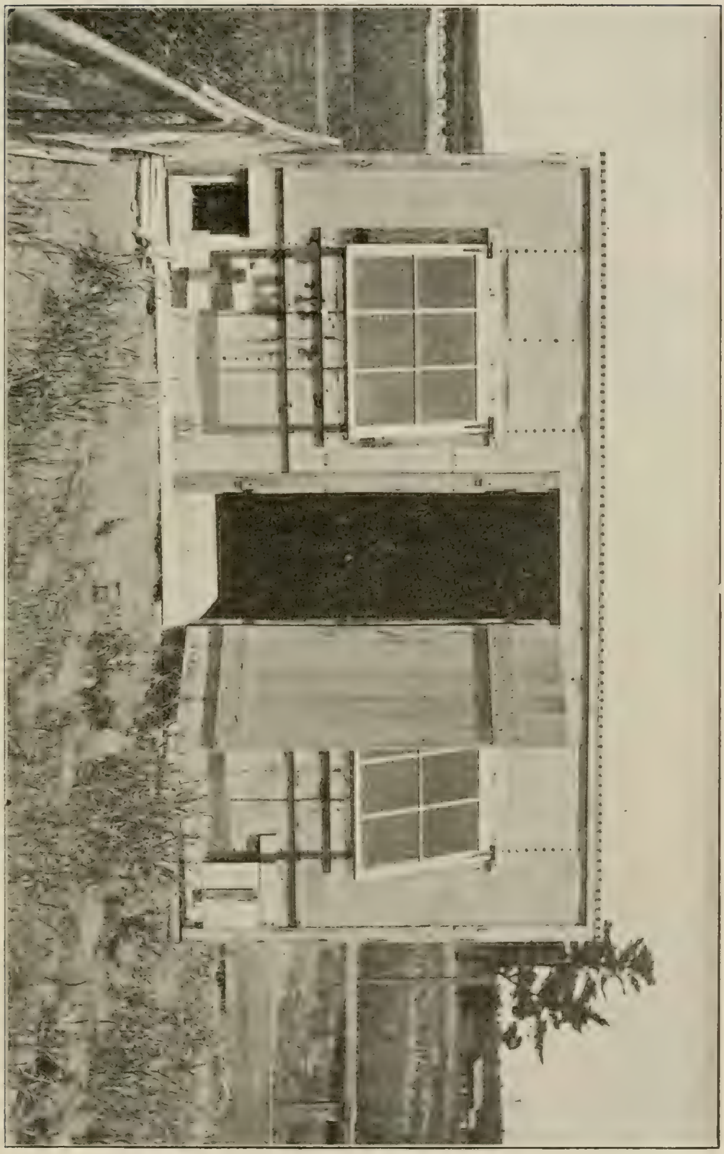

Figure 10. Movable brooder house. Described on page 52.

caring for lamps, turning and testing eggs, and other necessary work.

The house is one story and has four good well finished rooms, with lavatory and closet, on the first floor, and a large unfinished attic on the second floor. A shed for fuel and storage extends in the rear of the building and shelters the rollway entrance. The outside aspect of the building and its surroundings are attractive.

Brooder Houses.

Portable brooder houses of several different sizes and styles of construction are in use, sufficient to accommodate 2,000 chickens to maturity. The houses which have proved most satisfactory are built on shoes so they can be drawn near together for convenience in the brooding season, during April, May and June, and then to the grass fields for the range season.

Each of the houses accommodates 125 or 150 chicks from the time brooding commences until they are moved into winter quarters. They are large enough so the necessary work can be done comfortably in them. During rainy days, when the birds must be kept indoors, there is room for them, and they will not suffer seriously if the floors are generously covered with cut clover or chaff. The birds in them are safe at night from storms, and all thieves that walk on four feet, or fly.

Such houses are almost indispensable to the person who raises few or many chickens. Their use removes many of the obstacles that tend to annoy and defeat the chicken raisers.

Each house is 12 feet long and 7 feet wide. The front wall is 6 feet 2 inches high, and the back 4 feet 2 inches high from floor to roof, inside. This allows a full grown person to stand erect in the front part of the house. The two shoes on which it is built are 4 by 6 inches in size and lie flat. Their ends are chamfered on the under side so as to give them a sled runner turn. They are 14 feet long, and extend a foot outside of each end of the building. An inch auger hole slanting backward, and outward, is bored through each end of the shoes. For convenience in moving the houses, a short chain with an eye bolt in each end, which can be slipped through the auger holes and keyed, is used.

The floors are of two thicknesses of boards, breaking joints so as to prevent the air from drawing through. The walls and

roof are boarded and the walls are covered with Red Rope Neponset, and the roofs with No. 2 Paroid Roofing material. A door 2 feet wide and 6 feet high is placed in the center of the front wall with a window on each side of it. Each window contains six lights of 10 by 12 glass in one sash. It is hinged at the top and turns out, like an ordinary storm window. It is either closely buttoned down, or held open at different spaces, by hooks of various lengths. The longest opening is a foot, which leaves the window slanting out at an angle sufficient to give plenty of fresh air in warm weather when both windows are open and the houses full of birds. The advantages of hinged, over sliding windows are, that in stormy weather, rains and winds do not beat in to wet or annoy the birds, and free ventilation is not interfered with. The windows are covered with wire netting on the inside. A slide door, a foot square, is made down at the floor, near each end of the front of the building, for the chicks to pass through. A temporary board partition about 15 inches high divides the building crosswise into halves. Two No. 4 Peep-O'-Day brooders are used in each of these houses. They are put about two inches away from the back wall so as to allow the free passage of air to the intake openings in the sides of the brooders. They set about a foot away from each end of the building, and this space is filled in with an elevated platform and incline, which allows the chicks to go out through the brooder door and down a broad easy grade to the floor.

The Peep-O'-Day brooders are all made alike, with the lamp door at one side and the chick door at the other. They are located so that the lamp doors are towards the middle of the building and about four feet from each other, which gives about two feet between the lamp door and the temporary partition, sufficient room in which to attend to the lamps.

The hinges to the brooder cover are changed, so as to bring them at the back, which allows the cover to turn up against the back wall out of the way. These portable houses are well made, of good material, and if the shoes are kept blocked up from the ground, they should last as long as other farm buildings.

When they are drawn to the range for the warm season, they are turned back to the south, so that the sun may not shine in to the windows to heat the house and make it uncomfortable for the birds. Facing the north, the houses furnish good cool shelter during the heat of the day.

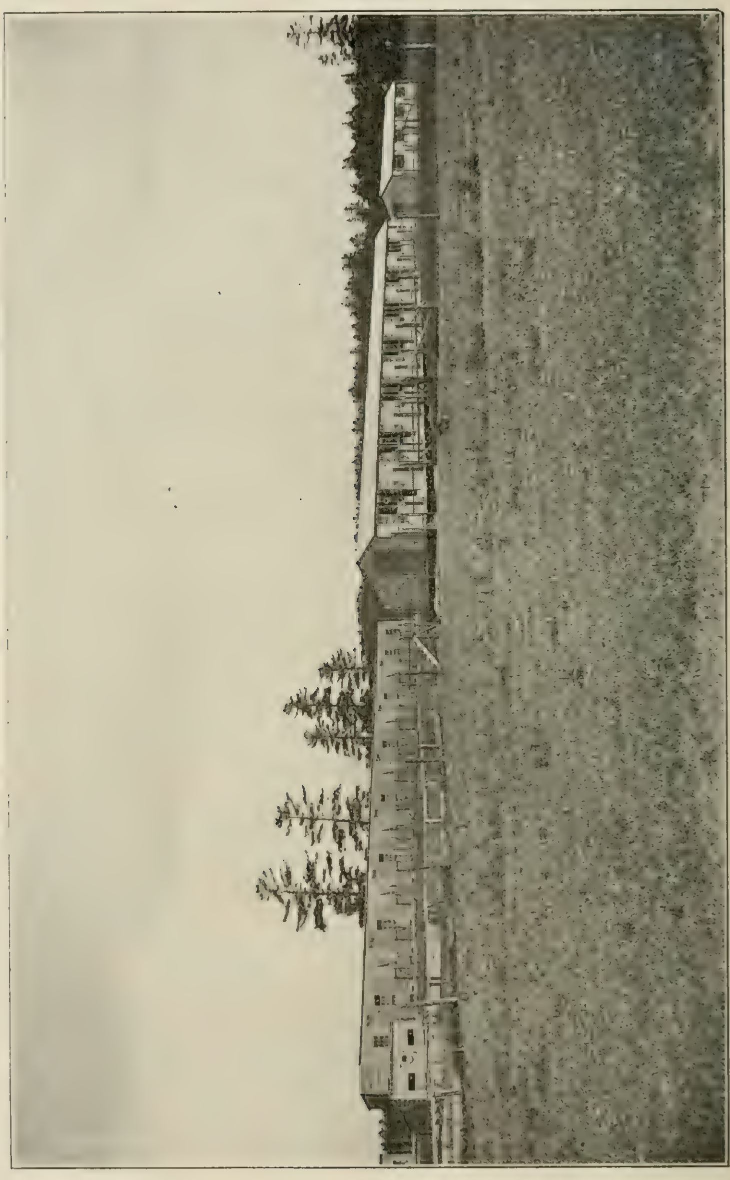

Figure 11. Laying and breeding houses at the Maine Experiment Station.

The houses which the pullets occupy are blocked up about a foot and a half and the open space between the house and the ground gives cool shelter which the birds enjoy. The pullets do not trouble about going under the houses to spend the night, but the cockerels do, and we find it necessary to board around the cockerel houses and deny them the cool retreat.

As the cockerels develop in September and October, they become quarrelsome and there are bullies among them, at every house, that domineer over their mates during the day, and stand guard at the doors at dark. With such fellows in the way it is difficult getting the underlings into the house at shutting up time at night, if they have a chance to skulk under the building.

Houses for Laying and Breeding Hens.

Two styles of houses are in use at the Station. One is a thoroughly made double walled building, 16 by 150 feet in size. It is always kept above freezing by a water heater and a flow and return, two-inch pipe, running the length of the building. This building was constructed with especial reference to comfort, health and productiveness. Small well made houses with single walls had formerly been in use, but they would get white with frost in cold weather, if shut up close enough so the birds did not suffer from cold during winter nights. When the weather moderated, the white frost would change to water and the straw litter on the floor would become damp and clammy. The birds showed their dislike for the damp straw by keeping off from it as much as they could. Such houses were unsatisfactory, and so the large warmed house was built. It was a decided improvement over the cold ones, because it could be ventilated and the birds not suffer with the cold. But it was not possible to secure sufficient ventilation, even though the house was moderately warmed, to prevent the presence of considerable moisture in the bedding.

Good yields of eggs were obtained from hens kept in that house and the losses of birds were not excessive. The hens showed, however, that they were not in the best condition by a little lack of color in comb, and energy in action. This house has not been abandoned and is highly prized for laying hens. Since breeding cockerels cannot be carried in the other houses, without danger of chilled combs, they are wintered in this warmed house until danger from chilling is past.

In seeking for some better system of housing the birds one of the small close houses, formerly used, was changed into an open house. The building was 10 feet wide and 25 feet long. An opening 3 feet wide and 15 feet long was made close up under the plate, and was left open every day in winter, except when the snow or rain blew in. At night the opening was covered with a framed curtain made of cotton cloth. An elevated roosting closet along the entire length of the back of the building was made warm, by packing the walls with hay. A close fitting frame-cloth curtain shut them in at night.

It did not freeze in the closet and the birds apparently did not suffer for lack of air. They seemed to enjoy coming out of the warm sleeping closet, down into the cold straw, which was never damp, as the whole house was open to the outside air and sun every day. There were no shut off corners of the floor, or closet that were damp. This building was used through three winters with 50 hens in it each year and did not have a sick bird in it. Not a case of cold or snuffles developed from sleeping in the closet with its cloth front, and then going directly down into the dry straw, in the cold room, and spending the day in the open air.

The birds laid as well as did their mates in the large warmed house. Their combs have been red and plumage bright and they have given every evidence of perfect health and vigor. While they are on the roosts, in bed, they are warm. They come down to their breakfasts and spend the day in the open air. Such habits of life seem to work equally well with brute or man.

After having used this so-called Pioneer house one year, a house was constructed 12 feet wide and 68 feet long. Its front and back walls were 5 feet high and the roof was evenly divided. It was divided into 2 rooms, each 34 feet long. The elevated roosting closets extended along the entire backs of each room and they were constructed inthe same manner as the one in the Pioneer house. The partition between the 2 rooms was made of 2 inch mesh poultry netting. There were 4 openings in the front of the building, 2 in each room, equal distances apart. Each opening was 3½ by 8 feet in size, fitted wtih frame cloth curtains, to be used only on winter nights and stormy days, in the same way that they were in the Pioneer house. These openings were put close up to the plates and came down to

within 1½ feet of the floor. There were no glass windows in the building.

This house was not satisfactory. There were currents of air from one end of the building to the other, even when there was little wind outside, and when the wind was high in winter the loose snow would be sifted in and distributed over a large part of the floor, dampening the litter and making life uncomfortable for the birds. The wire partition between the pens was replaced with one of close boards, and conditions were bettered; but each of the pens still had 2 openings, about 8 feet apart, and the same troubles from currents of air and sifting snow continued, although somewhat lessened. One of the openings was closed by screwing glass windows on the outside. This left each of the rooms with one opening and one large glass window.

This change entirely corrected strong air currents through the building and sifting snow, except in heavy storms when the wind is strong from the south. Of course the large opening allows the wind to blow into the room, but as there is no outlet for it except where it came in, there are no drafts of air across the birds to cause them to be uncomfortable and take colds.

Another difficulty remained; the opening came down to within 1½ feet of the floor, and the birds, sunning themselves on the floor or scratching in the litter, were in the direct course of the outside air as it came into the room and they tried to find sheltered corners where they might be more comfortable. On this account the width of the opening was reduced from 3½ feet to 2 feet by ceiling up the lower part of it. This gave a bulkhead 3 feet high, sufficient to protect the birds on the floor from the direct inflow of out door air, and they were happy.

One objection to this house still remains; its front wall is too low to allow room for a large opening, high enough so that the sun can shine in and back across the floor to the back wall during the short days in winter, when the sun runs low. This feature in construction, seems to be of the utmost importance, for dependence is had upon the sunshine and pure outside air, to keep the floor litter dry and the elevated roosting closet clean. The entire front of the roosting closet being open, leaves no dark corners where the air and light cannot do their thorough cleansing.

Experience with the house showed its several bad features, On the other hand, the Pioneer house, which had been in use for

three years, gave great satisfaction, and the same general plan was adopted in the construction of a large house.

This house, designated as House No. 2, was built three years ago. It is 12 feet wide and 150 feet long and is divided into 20 feet sections. In each section, with its floor surface of 240 feet, 50 pullets have been wintered each year, most successfully.

Two years ago another house was built on the same plan, except that it is 16 feet wide instead of 12. It is 120 feet long and consists of 4 sections or houses, each 16 by 30 feet in size. There is no separate walk through the building, but in the close board partition, separating the pens, are doors, hung with double acting hinges, which allow them to swing both ways, and close automatically, after the attendant passes through. Each pen has a floor surface of 480 feet and gives ample accommodation to 100 hens. All of the hens in these two open front houses, in flocks of 50 or 100, averaged laying 144 eggs each last year, and the birds were in excellent health. The front curtains were open all of the time every day, except the very stormiest in winter.

While the same plan is common to all of these open front houses, the width has been increased in each succeednig one built. The first house was 10 feet wide, the second 12 feet, the third 16 feet in width. The laying and breeding house at Go-Well Farm, described on another page, is 20 feet wide and is more satisfactory than the narrower houses, because of economy in cost, and its greater housing capacity in proportion to its length, which reduces the labor required in caring for the birds, by having them in square rooms rather than in long narrow ones.

Additional Opportunities for Investigation.

The poultry plant at the Station is devoted to experiment and research work. There are many questions relating directly to commercial poultry operations, that are left untouched because the Station plant was already taxed to its capacity.

When the Go-Well poultry farm was established, last year, the opportunities were so good for studying poultry subjects on a purely commercial plant, where the entire energies of the place are devoted to this one business specialty, that arrangements were made with its owner which enables the Station to

Figure 12. Interior of one section of curtain front house.

study the practical application of many of its own findings on an extensive, intensive business plant. Some of the results thus far obtained are made a part of the present bulletin.

GO-WELL FARM.

Of the hundred acres of land comprising the farm, thirty acres immediately at, and overlooking the village of Orono was fallowed and tilled for a year, then seeded to clover and grasses, in order to bring it into good condition for poultry farming.

The Barn and Incubator Room.

A barn of the Shrever plank frame pattern, 40 feet square, with 22 feet walls, was erected over a dry basement which has a heavy stone wall on 3 sides. The ground slopes away from the building on the east side sufficiently so that the large doors and windows in that side of the basement, open out on to receding ground, and renders the basement easy of access from a nearly level yard outside.

In addition to the 2 windows of 12 lights each, of 10 by 14 glass, in the east wall, the basement is lighted by 2 cellar windows in each of the 3 other sides. This gives a dry, well lighted room, 7 feet high and a little more than 36 feet square. It furnishes ample room for 24 of the largest Cyphers incubators, 5 or 6 barrels of oil, work tables and wide passages among the machines.

The windows on the exposed sides are shaded, when necessary, to protect from the warmth of the direct rays of the sun. During the spring months when the incubators are being used, the temperature of this room varies but little with changes in the weather outside. The first floor above the basement furnishes room for the storage of feed, machinery, appliances, and a general work room, while above it on the second floor, there was stored, last season, 40 tons of hay.

Brooder Houses.

There are 40 brooder houses built on shoes, so that they can be easily drawn about the farm to clean land when necessary. In size and construction, they are like the houses described under the heading,—Brooder Houses,—on pages 52 and 53.

In addition to the 80 Peep-O'Day brooders in these houses, there are 8 Cyphers out door brooders in use. Six thousand chickens are being raised this season (1906).

The Laying and Breeding House.

During the summer of 1905 a laying house was built to accommodate 2,000 hens. It is 20 feet wide and 400 feet long. It is on the same general plan as houses No. 2 and 3 at the Experiment Station. House No. 2 is 12 feet wide; house No. 3 is 16 feet wide, and this one is 20 feet wide. The widths have been increased in the last 2 houses, as experience has shown the advisability of it. At first it was thought the houses should be narrow so they might dry out readily, but the widest house dries out satisfactorily as the opening in the front is placed high up, so that in the shortest winter days the sun shines in on the floor to the back.

The economy in the cost of the wide house over the narrow ones, when space is considered, is evident. The front and back walls in the narrow house cost about as much per lineal foot as those in the wide house, and the greatly increased floor space is secured by building in a strip of floor and roof, running lengthwise of the building. The carrying capacity of a house 20 feet wide is 66 per cent greater than that of a house 12 feet wide, and it is secured by building additional floor space only. The walls, doors and windows remain the same as in the narrow house, except that the front wall is made a little higher. Three sills which are 6 inches square run lengthwise of the house, the central one supporting the floor timbers in the middle. They rest on a rough stone wall, high enough from the ground so that dogs can go under the building to look after rats and skunks that might incline to make their homes there. The stone wall rests on the surface of the ground. The floor timbers are 2 by 8 inches in size and rest wholly on top of the sills. All wall studs rest on the sills; the front ones are 8 feet long and the back ones 6 feet 6 inches long. The roof is unequal in width, the ridge being in 8 feet from the front wall. The height of the ridge from the sill to the extreme top is 12 feet 6 inches. All studding is 2 by 4 in size and the rafters are 2 by 5. The building is boarded with inch boards and papered and shingled with good cedar shingles on walls and roof. The floor is of two

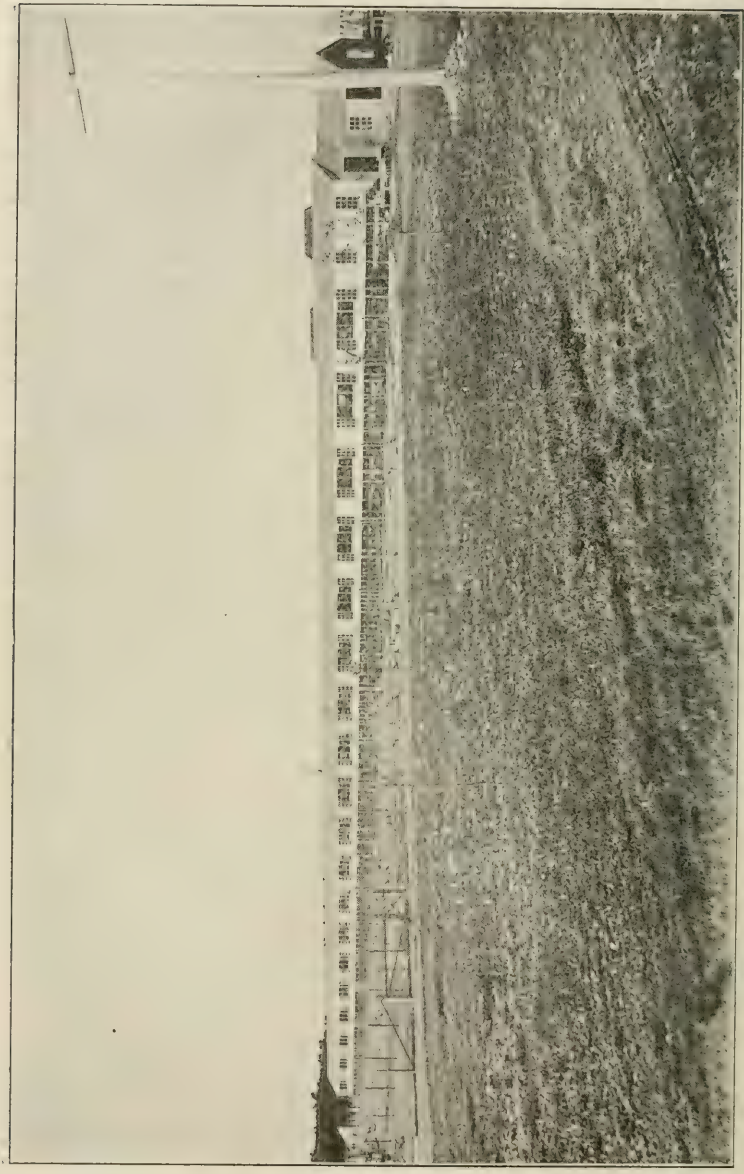

Figure 13. Laying and breeding house at Go-well farm. See page 61.

thicknesses of hemlock boards, which break joints well in the laying.

The building is divided by tight board partitions into 20 sections, each section being 20 feet long. All of the sections are alike in construction and arrangement. The front side of each section has two windows of 12 lights of 10 by 12 glass, screwed on, upright, 2 feet 8 inches from each end of the room. They are 3 feet above the floor. The space between the windows is 8 feet 10 inches long, and the top part of it down from the plate, 3½ feet, is not boarded, but left open to be covered by the cloth curtain when necessary. This leaves a tight wall, 3 feet 10 inches high, extending from the bottom of the opening down to the floor, which prevents the wind from blowing directly on to the birds when they are on the floor. A door is made in this part of the front wall for the attendant to pass through when the curtain is open. A door 16 inches high and 18 inches wide is arranged under one of the windows for the birds to pass through to the yards in front. It is placed close down to the floor. A similar door is in the center of the back wall to admit them to the rear yard when that is used.

A light frame, made of 1 by 3 inch pine strips and 1 by 6 inch cross ties, is covered with 10 ounce white duck, and hinged at the top of the front opening, which it covers when closed down. This curtain is easily turned up into the room where it is caught and held by swinging hooks until it is released.

The roost platform is made tight and extends along the whole length of the room against the back wall. It is 4 feet 10 inches wide and 3 feet above the floor, high enough so that a person can get under it comfortably when necessary to catch or handle the birds. There are three roosts framed together in two 10 feet sections. They are one foot above the platform and hinged to the back wall so they may be turned up out of the way when the platform is being cleaned. The back roost is 12 inches from the wall, and the spaces between the next two are 16 inches. They are made of 2 by 3 inch spruce stuff, placed on edge, with the upper corners rounded off. The roosting closet is shut off from the rest of the room by curtains, similar to the one described above. For convenience in handling, there are two of them, each 10 feet long. They are 3 feet wide and are hinged at the top so as to be turned out and hooked up. The space above this curtain is ceiled up and in it are two openings each 3

feet long, and 6 inches wide, with slides for ventilating the closet when necessary. There is a door in every partition, placed 5 inches out from the edge of the roost platform. They are 3 feet wide and 7 feet high; they are divided in the middle, lengthwise, and each half is hung with double acting spring hinges, allowing them to swing open both ways, and close.

Ten nests are placed against the partiiton in each end of the room, in two tiers. They are of ordinary form, each nesting space being one foot wide, one foot high and 2 feet long, with the entrances near the partition, away from the light, and with hinged covers in front for the removal of the eggs. Each section of 5 nests can be taken out, without disturbing anything else, and cleaned and returned. In constructing the house it was designed to use these nests only the present year. The framework where they rest was arranged for the use of trap nests, the intention now being to install them at the end of the present year, in October.

Troughs are used for feeding the mixtures of dry meals, shell, bone, grit and charcoal. The bottoms are made of boards 7 inches wide; the ends being of the same width and 18 inches high. The back is of boards and the cover is of the same material and slopes forward sufficiently so the birds cannot stay on it. A strip 5 inches wide is nailed along the front edge of the bottom to make the side of the trough. Pieces of lath are nailed upright on the front, 2 inches apart, between which the hens reach through for the feed. A thin strip 2 inches wide is fastened to the front of the trough at an angle of about 45 degrees to catch the fine meal that the birds pull out and would otherwise waste. They clear it up from this little catchall and so waste is mostly prevented.

Two lines of 4 by 4 inch spruce are arranged as an elevated track above the doors. The track extends the entire length of the building and being faced with narrow steel bands on top, a suspended car is readily pushed along, even when heavily loaded. The platform of the car is 2 by 8 feet in size and is elevated a foot above the floor. All food and water are carried through the building on this car. The 10 iron baskets, into which the roost platforms are cleaned every morning, are put on the car and collections made as the car passes through the pens to the far end of the building, 400 feet away, where the roost

cleanings are dumped into the manure shed. As the car is pushed along, the guard at the front end comes in contact with the doors and pushes them open and they remain so until the car has passed through, when the spring hinges force them to close again. This car is a great labor saver as it does away with nearly all lugging by the workmen. It has enabled one man to take good care of the 2,000 hens from November to March, except on Sundays, when the litter has been removed and renewed by other men.

At the end of the building there is a temporary food and water house for dish washing and scalding and where the car remains when not being used.

There is a walk outside of the building extending along its entire front. It is 4 feet wide and is made of 2 inch plank; it is elevated 2 feet above the floor of the building, which allows the doors, through which the birds pass to the front yards, to be opened and closed without interference. The door which opens out of each room through the curtain section, is above the outside walk and necessitates stepping up or down when passing through, which is not a very serious objection, as the door is used but little in the daily work, but mostly in cleaning out and renewing the floor litter. A guard of wire poultry netting, a foot wide along the outside of the walk, prevents the birds from flying from the yards up to the walks. The advantages of the elevated walk, over one on a level with the sill of the building is that it is unobstructed by gates, which would be necessary were the low walk used, to prevent the birds from passing from one yard to another.

The yards conform in width to the 20 foot sections of the house and are 100 feet deep. The fence is 5 feet high and is made from 2 strips of 2 inch mesh No. 19 poultry netting. By using 2 strips of 30 inch width, instead of one strip of double that width, 2 strong lines of wire are brought in the middle and the liability of bagging is much lessened, while the cost is not increased.

To give free passage for teams, to near the door of the building, openings 12 feet wide are left in the yard fences. They are 15 feet away from the front of the building, so that the road may not be obstructed by the snow which is liable to accumulate near the building. The frame fence sections, which fill in the

openings during the summer, are quickly taken out and replaced on cleaning days, and the delivery of bedding and worn litter back and forth, from wagon to buildings, is very directly made.

Yards, similar to those in front, will be constructed in the rear of the building and by alternating their use it is hoped to keep them clean, and more or less covered with green plants .

Packing and Shipping House.

A house 20 by 24 feet in size was made, in which to handle and pack the eggs for market. Its walls are packed with planer shavings, to prevent too great changes in temperature during extreme weather. It is well heated and lighted. The eggs are expressed to market when not more than one day old. The express company takes the shipments at the house daily and returns the empty crates.

Residence of Foreman.

A neat four-room cottage house, finished and painted, was built for the foreman and his family. It has long distance telephone connections and in this way the foreman is within reach of the owner at all times.

Every building on the plant is new, having been constructed for the special purpose of poultry business. The equipment is also entirely new and uniform, only one kind and size of incubators, and one kind of indoor brooder being used, which relieves the operators of the annoyances which arise from the use of different kinds of machines.

Investigation Relating to Breeding to Increase Egg Production in Hens.

In 1898 the Maine Agricultural Experiment Station designed and constructed fifty trap nests and put them in use by the pullets kept that year. From time to time, the work has been extended until now 200 trap nests are in use by a thousand hens.

By the trap nest it is possible to know the exact daily work which every hen is doing. At the end of the year those that had laid 160 eggs, or over, were selected and saved for breeders. They were bred to males whose mothers had laid 200, or more, good eggs per year. No female has been used in the breeding pens, for six years, whose mother did not lay at least 160 eggs in her pullet year. No males have been used as breeders unless their mothers laid above 200 eggs per year. The breeding pens

are now filled with birds of both sexes, that have six generations of mothers and fathers before them, that were bred under these rigid rules of selection.

The stock commenced with in 1898 had been laying about 120 eggs each per year for several years, as shown by the flock records. During the last two years, the hens have averaged 144 eggs each, during their pullet year. There seems to be reason to conclude that the producing capacities of the hens have been increased by about 2 dozen eggs per year. Perhaps this increase is not all due to the selection and breeding. The dry feeding and open air housing, doubtless, have contributed to the improvement. But, reason about it as one may, the fact remains that not a drone or small producer, backed only by beauty of form, feature, or color has had a place in the breeding of these birds in any of the last 6 generations.

The purpose of this work must not be misunderstood. The attempt is not to produce a stock of birds that shall average to produce 200 eggs per year. If by continued work a family of birds can be permanently established that with reasonable treatment, will yield 12 dozen eggs each per year in flocks of 100, it will be a matter of great consequence to the poultry industry. These yields are already being obtained in the Station flocks. There is no reasons why the stock should not yield as well in other hands, but in order for succeeding generations of birds to do so, it will be necessary to at least use male birds whose breeding has been based on performance.

The question is frequently asked if the stock is not likely to be weakened by inbreeding, since male birds are not purchased from outside flocks. There is no reason to go outside for fresh blood. This season there are 82 hens in the breeding pens, each of which has yielded 200 to 251 eggs in a year. The different matings made with so many birds makes easy the selection of only distantly related males and females when making up the breeding pens. The number of the breeding birds carried makes easy the avoidance of inbreeding, and this is strictly guarded against, as it is doubtful if the inbred hen has sufficient constitution to enable her to withstand the demands of heavy egg yielding.

During only one season, and then with but two small pens, have birds as closely related as first cousins, been bred together.

Line breeding is followed; the matings being only with distantly related birds. The birds are vigorous, of good size, and able to stand up under hard work. They have good, large, yellow legs and yellow beaks. They are well feathered and barred, but they are not bred for the fanciers or the show room, although there are many fine specimens in the yards.

As evidence that the function of heavy egg yielding has become fixed in the stock, attention is called to the fact that many male birds have been sent out to farmers and breeders in this, and other states, with which to improve the egg yields of their flocks. The many voluntary statements, from the purchasers, telling of the early and heavy egg yields from the pullets gotten by these cockerels, is substantial testimony to the utility of the stock; and added to the known average increase of 2 dozen eggs per bird for the hens in the Station flocks argue well for the breeding.

Other Methods of Selecting Breeding Stock.

The only reliable method of selecting breeding stock is by aid of the data secured by the use of trap nests. It is, however, only investigators, large operators, and breeders who make a business of producing birds and eggs for breeding purposes, for sale, who can afford the equipment and expense of operating trap nests. Most poultrymen and farmers who carry small flocks are usually too busy to give the regular attention required by any reliable and satisfactory trap nest. They can better afford to buy the few males required each year from some one who makes breeding stock by trap nesting a specialty.

There are one or two concerns that advertise to teach how to pick out the pullets that are to be good layers, and how to pick out the hens that have laid well. The price for the system is $10 by one of the concerns, with a bond of $1,000 to keep the secret. The warm friends of both systems tried them on some pens of trap nested birds at the Station with known records, and both parties went away sorrowing at the results of their work. Their systems were unknown to the writer but it does not matter, for both were completely valueless as applied here.

Two others came to show that it was not necessary to use trap nests. One claimed to be able to tell the laying capacities of pullets by the positions of the pelvic bones; while the other was sure he could tell the yields for the coming year, to within 8 or

10 eggs, by the length and shape of the toe nails. Another was sure that large combs are infallible indications of great egg laying capacities.

There are 80 birds in one yard at the Station each one of which has laid from 200 to 251 eggs in a year. So far as can be discovered, they differ from each other sufficiently to upset any theory of selection thus far put forward. One feature is common to all these hens. They all have strong constitutions.

EARLY MATURITY INDICATIVE OF GOOD LAYING.

A year ago last August and September, 29 pullets were selected on the range that were laying in the brooder houses, or about commencing doing so, as shown by their red combs, and their prating and following the caretaker about the field, talking about the things they were going to do, in true hen language, which is easily understood and not to be mistaken, by any one who knows chickens. These young birds were carried into the laying house, banded, and given the regular treatment for laying hens. Records were kept with each individual for 365 days forward from the day on which each one gave her first egg.

Four birds died during the year, and the 25 remaining averaged laying 180 eggs each. Two of the 4 that died had done good work; one having laid 148 eggs up to July 30, and the other 150 up to April 7. Eight of the 29 birds laid over 200 eggs each. The only poor layers in the lot were two of those that died; one laying 58 to March and the other 113 to June.

The average production of all the pullets kept in the regular work last year was 144 eggs per bird. The average of 180 made by this lot, and the small number of poor yielders in it, show the advantages of selecting the early layers for breeding purposes. Those selected were of the most forward pullets.

To the farmers and small poultrymen who do not use trap nests, this plan of selecting the breeding females has much to commend it. The method is simple. There is no secret about it. It is just common sense. Such pullets, bred to males, purchased from some reliable breeder, who practices trap nest selection of his breeding stock, ought to improve the egg yielding capacities of the flocks.

The table shows the individual records of these pullets, during the 365 days following the recording of their first eggs; and it also shows their yields up to the end of October,—the regular time of closing the year's records.

This list includes all of the birds that were put into the test; showing those that died as well as those that continued through the year.

Records of early maturing pullets.

Number of hen.	Date on which the first recorded laying was made.	Number of eggs laid during the first 365 days.	Number of eggs laid to October 31, 1905.
1	September 1, 1904	153	180
2	September 1, 1904	143	167
3	September 20, 1904	142	162
4	September 1, 1904	190	223
5	September 20, 1904, died July 30	148	....
6	September 20, 1904, died March 20	58	....
7	September 10, 1904	185	226
8	September 10, 1904	188	221
9	October 1, 1904	204	218
10	October 10, 1904	162	171
11	September 6, 1904	139	150
12	September 25, 1904, died June 24	113	....
13	October 1, 1904	182	198
14	September 1, 1904	137	160
15	September 1, 1904	170	199
16	October 1, 1904	208	229
17	September 1, 1904, died April 7	150	....
18	September 1, 1904	158	177
19	September 1, 1904	185	222
20	September 6, 1904	160	163
21	September 10, 1904	190	222
22	October 1, 1904	210	228
23	October 1, 1904	201	209
24	September 8, 1904	217	251
25	October 1, 1904	205	210
26	September 1, 1904	212	248
27	September 1, 1904	239	265
28	September 1, 1904	145	171
29	September 12, 1904	178	199
	Average of 25 birds for 365 days	180	....

Growing the Chickens.

The chicks are allowed to remain in the incubator until they are about 48 hours old. They are then strong, steady on their legs and hungry.

The temperature under the brooder hover is kept between 95 and 100 degrees during the first week; reducing it about 5 degrees during each of the next three weeks. Great care should be exercised that the floor of the brooder does not get too warm. After they are 3 or 4 days old, they are taught, little by little, the road down, and out on to the floor, which is covered with half an inch of sand and an inch or two of dry cut clover, or clover leaves and chaff.

The best method of feeding young chicks is at present a matter of some uncertainty. Many different kinds of food and different ways of feeding give good results.

One condition appears to be imperative and that is, that the young things, until they are at least three weeks old, be not allowed to overeat. We have guarded against this by watching them closely and examining their crops for emptiness just before feeding time. This enables them to eat 4 good meals a day and be hungry at feeding time. Where regular full meals are given them they are allowed at the troughs only a short time. A long drawn out meal to enable them to clean up the dishes impairs their digestion, and ruin follows.

Where small broken grains and meals are kept constantly within reach of the young things, either in the litter or small troughs, the crops never appear to be empty, neither are they ever crammed full as they are when fed at regular hours, and yet the birds live well and seem to thrive when they are within easy reach of food all of the time.

At the present time the Station is studying young chick feeding closely, for it is the most difficult feature of the whole poultry industry. We can now give no better method than that practiced in raising the chicks during this and the last season, because by it few birds have been lost and good thrift has been secured.

Infertile eggs are boiled for half an hour and then ground in an ordinary meat chopper, shells included, and mixed with about 6 times their bulk of rolled oats, by rubbing both together. This mixture is the feed for 2 or 3 days until the

little things have learned how to eat. It is fed sparingly, in the litter and sand, on the brooder floor.

About the third day, they are fed a mixture of hard, fine broken grains, i. e., cracked corn, wheat, millet and pinhead oats, as soon as the birds can see to eat in the mornings. This is fed in the litter, care being taken to limit the quantity so they shall be hungry at 10 o'clock. Several of the prepared dry chick foods have been tested. They are satisfactory when made of good, clean grains without grit. The grit and charcoal can be supplied at less cost and must be freely provided.

At 10 o'clock the rolled oats and egg mixture is fed, in tin plates with low rims. After they have had the food before them 5 minutes the dishes are removed and they have nothing to lunch on, except a little of the fine broken grain which they scratch for. At one o'clock the hard grains are again fed, as in the morning, and at 4.30 to 5 o'clock they are fed on the rolled oats and egg mixture, giving all they will eat until dark.

When they are about 3 weeks old, the rolled oats and egg mixture is gradually displaced by a mixture made up of 2 parts by weight, of good clean bran, 4 parts corn meal, 2 parts middlings or red dog flour, 1 part linseed meal and 2 parts screened beef scrap. This mixture is moistened just enough with water so that it is not sticky, but will crumble, when a handful is squeezed and then released. The birds are developed far enough by this time so that the tin plates are discarded for light flat troughs with low sides.

The hard broken grains may be safely used all the way along and the fine meals left out, but the chicks do not grow so fast as when the mash is fed. There seems to be least danger from bowel looseness when the dry grains only are fed, and it is very essential that the mash be dry enough to crumble, in order to avoid that difficulty. Young chicks like the moist mash better than though it was not moistened, and will eat more of it. There is no danger from the free use of the properly made mash, twice a day, and being already ground the young birds can eat and digest more of it, than when the food is all coarse. This is a very important fact and should be taken advantage of, at the time when the young things are most susceptible to rapid growth. But the development must be moderate during the first few weeks. The digestive organs

must be kept in normal condition by the partial use of hard foods, and the gizzard must not be deprived of its legitimate work and allowed to become weak by disuse.

By the time the chicks are 5 or 6 weeks old, the small broken grains are discontinued and the 2 litter feeds are wholly of screened cracked corn and whole wheat. Only good clean wheat, that is not sour or musty, should be used.

FINISHING THE BROILERS.

When the chickens are about 9 or 10 weeks old, and the cockerels weigh a pound and a quarter to a pound and a half, the cockerels are put by themselves, into vacated brooder houses, 100 to a house. Each house has a yard in front, about 12 feet square. They are fed on porridge, 3 times a day, in V-shaped troughs, with 4-inch sides. The porridge is made of 6 parts corn meal, 2 parts middlings, ½ part linseed meal and 2 parts beef scrap. Not having milk, it is mixed with tepid water. It is made thick enough so it will drop and not run, from the end of a wooden spoon. They are given all they will eat in half an hour, when the troughs are removed and cleaned. When the yards get dirty, they are bedded down with sand, straw or hay. The birds will stand this feeding for 2 or 3 weeks with good appetites. When they commence taking less food they are dressed for market and usually weigh about 2¼ pounds dressed weight.

FOOD AND OTHER MATERIAL REQUIRED TO GROW CHICKS TO BROILER SIZE.

To make broiler raising most profitable, warmed houses should be used and the birds raised early enough to be all marketed while high prices are obtainable.

The Station does not make a specialty of broiler raising. The chickens are raised so as to obtain the pullets for egg laying. The surplus cockerels are disposed of by growing them rapidly and getting them off to market before they annoy the pullets. As the cockerels and pullets are raised together, and the cockerels only are finished and sold as broilers, it is not possible to state just how much of the food given to the flock has been eaten by the cockerels, as they were larger and evidently ate more per bird than the pullets did. The quan-

tities of food eaten, aside from labor, have been accounted for, in the work, and the records show that when the chicks that were hatched in April and May were 11 to 12 weeks old, the cockerels weighed about 2¼ pounds, dressed for market. Up to this time the cockerels and pullets had each averaged to eat 9 pounds of grain food, 1 pound of beef scrap and ¼ pound of grit.

When the cockerels average 2¼ pounds dressed weight, the pullets of the same age averaged 1¾ pounds, and as there were equal numbers of cockerels and pullets in the lot, the average weight of all the birds at that time was 2 pounds. Five pounds of the grain and meat foods were required to produce a pound of dressed broiler, under the described conditions and practices.

The material used in the production of a 2-pound broiler cost as follows:

10 lbs of food..................	16.5 cents.
Oil for incubating and brooding..	2.5
Eggs incubated	4.0
Total	23 cents.

The labor involved in raising the chick and preparing it for market is not accounted for. The average prices received for each 2-pound broiler last June was 60 cents; July 50 cents, and August 40 cents.

DEVELOPING THE PULLETS.

When the cockerels are taken out for finishing, the pullets of the same age are moved to the grassy range, still occupying the same portable houses in which they were raised. At this time the method of feeding is changed, and dry food is kept by them constantly, in troughs with slatted sides and broad detachable roofs, so it may not be soiled or wasted. The troughs are from 6 to 10 feet long, with the sides 5 inches high. The lath slats are 2 inches apart and the troughs are 16 inches high from floor to roof. The roofs project about 2 inches at the sides and effectually keep out the rain except when high winds prevail.

The roof is easily removed by lifting one end and sliding it endwise on the opposite gable end on which it rests. The

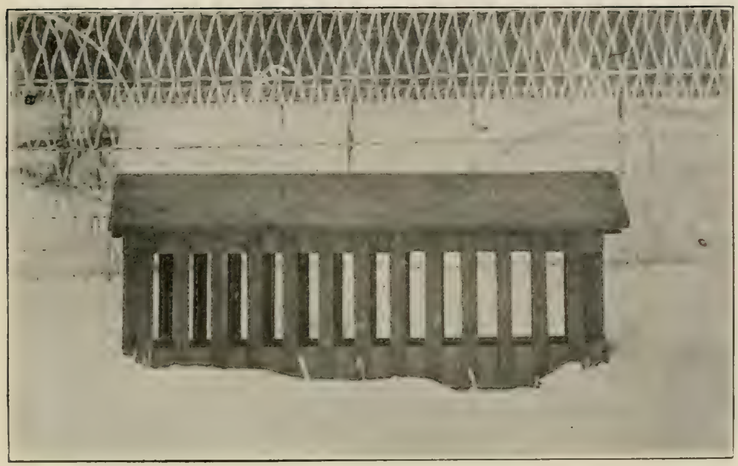

FIG. 14. Dry feed trough with sliding roof.

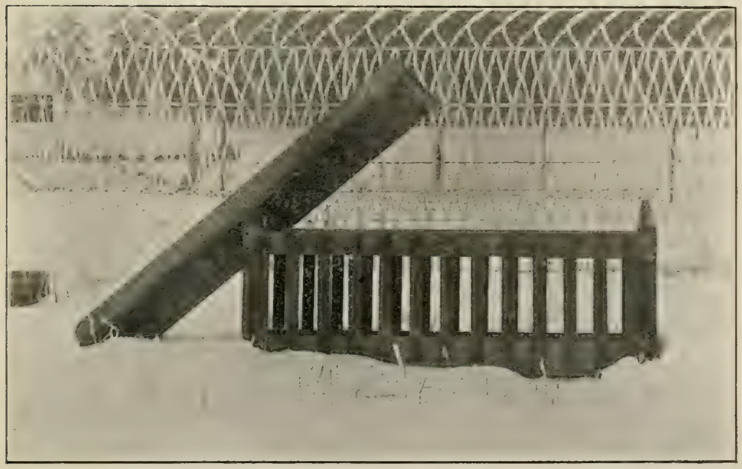

FIG. 15. Dry feed trough with roof removed. Described on page 74.

trough can then be filled and the roof drawn back into place without lifting it. This arrangement is the best thus far found, for saving food from waste and keeping it in good condition. When dry mash is used in it there may be considerable waste by the finer parts being blown away. When used for that purpose it is necessary to put it in a sheltered place out of the high winds.

In separate compartments of the troughs, they are given cracked corn, wheat, oats, dry meal mixture, grit, dry cracked bone, oyster shell and charcoal. The dry meal mixture is of the same composition as that fed to the laying hens, described on page 78. The troughs are located about the field in sufficient numbers to fully accommodate all of the birds.

The results of this method of feeding are satisfactory. The labor of feeding is far less than that required by any other method followed. The birds do not hang around the troughs and over-eat, but help themselves, a little at a time, and range off, hunting, or playing and coming back again, when so inclined, to the food supply at the troughs. There is no rushing, or crowding about the attendant, as is usual at feeding time, where large numbers are kept together.

For the last 7 years we have gotten the first eggs when the pullets were from 4 months and 10 days, to 4 months and 20 days old. There is some danger of the pullets getting developed too early, and commencing laying too soon for best results, under this system of feeding. In order to prevent such conditions, the houses should not be located too close to each other, or to the feed troughs, and a large range should be given them so they may be induced to work, which they will do, if given the opportunity early after their removal to the fields. Should the birds show too great precocity, and that they are liable to commence laying in August, the supply of cracked corn in the feeding trough is reduced, or taken away altogether, which causes them to eat the wheat, oats and dry meal instead, and they continue to grow and develop without getting too fat and ripe.

During the last days of October it is our practice to move the pullets into the laying house.

COST OF PULLETS RAISED FOR LAYERS.

Last season 2,000 pullets were raised for layers and the following materials were used in producing each one:

28 pounds of	grain, meal and scrap, costing....	44.5 cents.
3/4 "	cracked bone	1.5
1/2 "	oyster shell	.25
2 1/4 "	Mica Crystal Grit...............	1.25
1/2 "	charcoal	.5
1 1/2 pints of oil	....	2.5
2 eggs	....	4.0
		54.5 cents.

Before they were moved into winter quarters, many of them were laying in the brooder houses, and the eggs from them at that time had sold for a hundred dollars.

Feeding the Hens.

For many years warm mashes made from mixtures of different meals, sometimes with the addition of cooked vegetables, were given to the hens every morning during the winter season and in warm weather mashes of similar composition but mixed with cold water were fed. The hens seemed to like mashes made in this way better than anything except corn, and if fed anywhere near enough to satisfy their appetites, they would load themselves with food and then sit down in idleness during the early part of the day. They were not willing to scratch in the floor litter for the wheat, oats and cracked corn that had been buried there for them.

The losses of hens from what appeared to be the system of feeding, caused the change of the time of feeding the mash, from morning until near night, and giving the cracked corn, wheat and oats, in the litter, in the morning and near noon.

These changes resulted in the better health and productiveness of the birds, but the crowding for the mash at feeding time and the hurried filling of their crops to repletion even near bed time, did not argue for the best.

Several different plans of feeding were compared by testing them for a year and finally the moist mash was abandoned altogether. The present system of feeding has been practiced

here for two years and is regarded as the best method thus far used. The dry meal mixture is composed of the same materials, in the same proportion as the moist mash was, but the method of feeding it is different. It is kept within reach of the birds at all times, but they never stuff themselves with it, either because they do not fear an exhaustion of the supply by their competing mates, or else it does not taste so good to them as to cause them to eat of it to repletion. Yet they appear to eat enough of it. It is rich in the materials from which hens make eggs. Hens that lay many eggs must be generously nourished. In the changes in feeding made here, it was not the quantity or composition of the ration that was altered, but the feeding habits of the birds.

It is not proven that our present system for feeding is the only correct one. Some other methods may be better, but at the present time it is giving excellent satisfaction with Plymouth Rocks.

DRY FOODS ONLY.

Early in the morning for each 100 hens, 4 quarts of screened cracked corn are scattered in the litter, which is 6 or 8 inches deep on the floor. This is not mixed into the litter, for the straw is dry and light and enough of the grain is hidden so the birds commence scratching for it almost immediately. At 10 o'clock they are fed in the same way, 2 quarts of wheat and 2 quarts of oats. This is all of the regular feeding that is done.

Along one side of the room is the feed trough, with slatted front. In it is kept a supply of dry meals mixed together. This dry meal mixture is composed of the following materials, viz.:

200 lbs. good wheat bran,
100 lbs. corn meal,
100 lbs. middlings,
100 lbs. gluten meal or brewers' grain,
100 lbs. linseed meal,
100 lbs. beef scrap.

These materials are spread on the floor in layers one above another and shoveled together until thoroughly mixed, then kept in stock, for supplying the trough. The trough is never

allowed to remain empty. The dry meal mixture is constantly within reach of all of the birds and they help themselves at will.

Oyster shell, dry cracked bone, grit and charcoal are kept in slatted troughs and are accessible at all times. A moderate supply of mangolds and plenty of clean water is furnished. About 5 pounds of clover cut into inch lengths is fed dry, daily to each 100 birds, in winter. When the wheat, oats and cracked corn are given, the birds are always ready and anxious for them and they scratch in the litter for the very last kernel, before going to the trough where an abundance of food is in store.

It is very evident that they like the broken and whole grains better than the mixture of the fine, dry materials; yet they by no means dislike the latter, for they help themselves to it, a mouthful or two at a time, whenever they seem to need it, and never go to bed with empty crops, so far as noted. They apparently do not like it well enough to gorge themselves with it, and sit down, loaf, get over-fat and lay soft-shelled eggs, as is so commonly the case with Plymouth Rocks when they are given warm morning mashes in troughs.

Some of the advantages of this method of feeding are that the mash is put in the troughs at any convenient time, only guarding against an exhaustion of the supply, and the entire avoidance of the mobbing, that always occurs at trough feeding, when that is made the meal of the day, whether it be at morning or evening. There are no tailings to be gathered up or wasted, as is common, when a full meal of mash is given at night. The labor is very much less, enabling a person to care for more birds than when the regular evening meal is given.

The average amounts of the materials eaten by each hen during the last year are about as follows:

Grain and the meal mixture.....	90.0 pounds.
Oyster shell	4.0 pounds.
Dry cracked bone..............	2.4 pounds.
Grit	2.0 pounds.
Charcoal	2.4 pounds.
Clover	10.0 pounds.

These materials cost about $1.45.

The hens average laying 144 eggs each.

SUCCULENT FOODS AND CLOVER.

Succulent foods are supplied to all birds, each day throughout the year. The double yards allow the birds to gather green grass, young oats, rye or rape for themselves during the growing season, as they are turned from the worn run to the fresh ones, when the supply of green plants is eaten off. If the sod is much broken, or the plants injured so they will not spring up and cover the surface with green again, the vacated yards are cultivated and reseeded heavily.

When buildings are new and the runs are fenced in from land with a good sod on it, the yards may last a year or two without the sod being used up, but unless they are large, it will soon be necessary to cultivate and reseed, if they are depended upon to furnish green food. The yards, 20 by 100 feet, are large enough so that there is room for a single horse to work comfortably in them. It is questionable whether it might not be more economical to construct only single yards for exercise, and feed the hens daily on green food, which could be raised on rich land, handy by. Probably less labor would be required to raise the green food in the fields than in the yards, but the labor of cutting and carrying it to the birds would be considerable.

For green food during winter and spring mangolds are used. They are liked by the birds and when properly harvested and cared for remain crisp and sound until late spring. They are fed whole, by sticking them on to projecting nails, about a foot and a half above the floor. Care must be exercised in feeding them, as they are laxative when used too freely. On the average about a peck per day to 100 hens, can be safely used. They would eat a much greater quantity if they could get it.

A 4 months' feeding test, extending from January 1 to April 30, 1906, in which mangold wurzels were compared with cut clover, has just been completed. Two lots of hens, each consisting of 100, were kept under similar conditions, both lots being fed as described on page 77, except that one lot had about 17 pounds of mangolds each day and no clover; while the other lot received no mangolds, but were given 5 pounds of clover leaves and heads, gathered from the feeding floor in the cattle barns. Both lots of birds had new beds of oat straw

every week. The 100 birds eating the mangolds averaged laying 63.9 eggs each, during the four months. The 100 birds eating the clover, averaged 59.6 eggs during the same time. The slight difference between the yields of the two lots can hardly be regarded as indicating greater value for the mangold ration.

The vigor and apparent healthfulness of the two lots were equally good. In the general feeding both mangolds and clover are used daily. Formerly it was thought necessary to steam, or wet the clover with hot water in order to get good results from it. It is now cut and fed dry, in the bottom of cement barrels, cut off about ten inches high. About 5 pounds are eaten daily, by 100 hens, with very little waste. Apparently as good results are gotten from it as when it was scalded; the labor of preparation being very much lessened.

Time Required to Establish Fertility in the Eggs of Hens When First Mated.

Fifty Barred Plymouth Rock hens, one year old, that had been laying well throughout the preceding winter and spring, and had been kept away from male birds since they were 12 weeks old, were mated with cockerels and their eggs incubated, to determine how soon after introducing male birds into pens of virgin hens, the eggs may be sufficiently fertilized for incubating purposes.

Table showing the results of incubating the eggs from 50 hens during the first 7 days of mating.

	Number of eggs laid.	Infertile.	Weak development.	Strong development.	Chicks hatched out.
June 23	17	17	......	......	......
June 24	23	13	7	3	......
June 25	21	7	1	3	10
June 26	18	7	3	4	4
June 27	31	6	4	4	17
June 28	32	4	7	5	16
June 29	26	5	3	3	15

Three cockerels were put into the pen at 6 A. M. June 23 and the eggs collected and marked at 9 A. M., 12 M., 3 P .M. and 6 P. M. during that and the days following.

Incubation showed all eggs laid June 23 to be entirely infertile. Three eggs collected at 9 A. M. June 23 showed weak fertility. Four eggs collected at 12 M. of that day showed weak fertility, and two eggs collected at that hour were so strong in fertility that the embryoes in them developed to about the eighteenth day. In a previous test, reported in Bulletin 79 of this Station, two chicks were hatched from the eight eggs laid on the second day of mating.

On June 25th, the third day the birds were mated, they laid 21 eggs and from them 10 chicks were hatched out. The fourth day of mating did not show as good results, the 18 eggs yielding but 4 live chicks. During the fifth day of the mating, the 50 hens laid 31 eggs and they yielded 17 chicks. On the sixth day they laid 32 eggs and 16 chicks were hatched out, and on the seventh day the 26 eggs laid, yielded 15 chicks.

These results show that the eggs laid during the days immediately following the fourth day of mating, yielded rather more than 50 per cent of good chicks, which is about the percentage usual in the general incubation work here, which, however, is done earlier in the season, when conditions are supposed to be not as favorable.

Hatchability of the Eggs from the Same Hens During Ten Consecutive Months.

One of the most annoying and perplexing features of poultry work is the large number of eggs incubated, which do not yield chicks. Formerly when the hens lived in warm houses in winter and part of their food consisted of moist mashes, sometimes not more than a fourth of their eggs yielded live chicks. For the last 2 years the average of chicks hatched from the eggs laid by the hens in February and March, has been at the rate of one chick to about 2 eggs, and for those laid during April, less than 2 eggs have been required to yield a chick.

It is hoped that means may be devised by which the present wastes may be reduced, even where chicks are raised in large numbers. In order to study the hatchability of the eggs from the same lot of hens, through their first laying year, a pen of 50 pullets was set apart for the purpose. They were hatched

late in May and commenced laying in October, continuing laying moderately, through November and December. The 50 birds were mated in November with 2 cockerels, that did not quarrel, and these matings continued through the 10 months' test.

Three of the 50 died and did not do a full year's work, and 7 others laid irregularly and are not considered in the data given below.

The hatchability of eggs from the same forty hens each month from January to October.

	Number eggs laid during each month.	Number eggs laid and incubated during first ten days of each month.	Results of incubating the eggs, as shown in percentages of the numbers incubated each month.			
			Per cent chicks hatched out.	Per cent infertile or slightly started.	Per cent in which development stopped by 12th day.	Per cent in which development stopped by 20th day or failed to get out of shell.
January	390	129	26	29	23	22
February	629	152	24	26	28	21
March	870	190	37	42	7	14
April	704	201	61	27	9	2
May	607	120	39	27	12	22
June	524	137	41	26	9	17
July	505	153	58	15	8	19
August	410	138	54	29	6	12
September	464	131	52	27	8	13
October	249	91	35	44	8	13

During the first 10 days in January, all of the eggs laid by the 40 birds were saved and incubated and the results noted. The same was done through the first 10 days of each succeeding month, ending with October. All of the eggs laid during the several 10-days periods, were incubated, none were rejected because of lack of size, irregular shape, or defective shells, as would have been done in ordinary selection. This, of course, reduced the percentages of hatchable eggs in all the periods. The results are given in the accompanying table.

The most impressive feature of the table is the per cent of chicks hatched from the July, August and September eggs. The hens had averaged laying 16.6 eggs each, per month, for the 5 months ending with June. July and August were warm months; the egg yields were lessened, and many of the birds were in partial moult, yet the eggs of July yielded 58 chicks per hundred, and those of August, 54 chicks. From this test there appears no support of the theory, that long continued laying reduces the chick-producing capacities of the eggs.

Every egg in the experiment was marked as laid, and its behavior in the incubator noted. Perhaps the data secured from the pen of 40 hens, considered collectively, is as valuable as though the histories of each hen's eggs were traced, individually for the 10 months.

The Effects of Long and Short Matings upon the Chick-Producing Capacities of Eggs.

As a matter of convenience for many years past our breeding pens have been made up in November. The expense and difficulties of providing roomy pens for the cockerels, separate from the hens, have been the reasons for so doing. It has been easy to see, when the two sexes have been together for several months, that the hens have suffered from the too constant attentions of the cockerels. They have given evidence of this by their somewhat worn condition and loss of feathers from backs and necks, as compared with their sisters, in other pens, where there were no cockerels. The egg yields were no less in the mated, than in the unmated pens, and to appearances the eggs were of as good size in one class as the other.

However that may be, it has been a matter of serious question whether the eggs laid by hens that had been mated so long, with cockerels that had 3 or 4 months' service, were in as good condition for chick yielding as those from freshly mated males and females.

On the first of last November, 15 pens of pullets were set apart for breeding purposes. The birds were hatched between April 1st and May 14th, and had not been with cockerels since they were 12 weeks old. Nine of the pens were mated November 25th by putting 6 cockerels into each pen of 100 pullets. They all ran together and mated at will, until February 24th,

when the 6 cockerels in each pen were divided into 3 lots, of 2 each. Each lot of 2 cockerels was allowed in turn a half day's freedom, one lot being shut up, and another lot liberated at noon and night, each day. When not at liberty, each 2 cockerels were in coops, 2½ by 6 feet in size, in company with about half the broody hens of the pen. The coops were light and the birds on the floor were in plain sight of the prisoners at all times.

The other 6 pens of females were kept separate from the males until February 24th, when they were mated with brothers of the cockerels employed in the 9 pens described above. The cockerels and pullets in the 6 pens were fresh, never having been in service. The 6 cockerels assigned to each pen were divided into lots of 2, and each lot given their liberty, alternately, just as they were in the first 9 pens.

The saving of the eggs for incubation was begun March 2, 6 days after regular mating commenced. The eggs were saved from each lot until March 17th, when they were incubated under similar conditions. From the pens where the males and females had run together all winter, 3,240 eggs were incubated and 1,529 chicks hatched out, an average of about one chick from 2⅛ eggs. From the pens where the males and females had not been together until the breeding season commenced on February 24, 2,160 eggs were incubated, and 1,075 chicks hatched out,—an average of two eggs being required to yield one chick.

These slight differences in results should not be interpreted as meaning that there are advantages in the short, over the long matings, for so small differences are liable to show in any pens of birds, however treated. Much more marked differences in results would be needed, to indicate that the running together of both sexes, at will, during several months prior to the breeding season, is detrimental to the chick-producing capacities of the eggs.

While the results of this test may not be convincing, the 1,500 birds employed and the large number of eggs incubated, with the satisfactory average yields of a chick from 2 eggs, does furnish data sufficient to remove scruples regarding the fitness of long-mated birds for breeders.

INDIAN CORN AS A FOOD FOR MAN.

L. H. Merrill.

Among the benefits which accrued to civilized man through the discovery of the New World, the acquisition of Indian corn must be considered as one of the greatest. Its excellence seems to have quickly impresed itself upon the early settlers, and the history of the American Colonies was from the first closely identified with this grain. Since corn is not only a native of the Americas but has been cultivated by the Indians and natives of Central and South America for 20 centuries or more, it is not strange that it was found to be admirably adapted to the climate and needs of this quarter of the globe. The alacrity with which it was adopted by the settlers was in itself sufficient tribute to its excellence. It seems to have been the only food plant cultivated by the Indians, and so exclusively was it grown that the word corn, which formerly signified any cereal food grain, soon lost its original meaning and came to be applied exclusively to Indian corn, although the wider use of the word is still retained in England. It was a long time before this grain ceased to be the most important of our food cereals; indeed, it is scarcely a century since wheat has assumed the leading place to which its superior bread-making qualities entitle it.

Although Indian corn now occupies the second place in importance among the cereals which in this country serve as food for man, it far exceeds wheat in the size and value of the crop produced. In 1611 the James River settlement had 30 acres of corn under cultivation. In 1621 the Massachusetts Bay colony boasted 20 acres devoted to the same crop. In 1905 there were in the United States 94,000,000 acres in corn, and the crop attained the almost incredible size of 2,707,993,540 bushels, with a value of $1,116,696,738. In the same year 47,854,079 acres were given up to wheat, and the crop was 692,979,489 bushels, worth $518,372,727. The acreage of corn

was double that of wheat, and the value of the crops was in about the same proportion.

It is difficult if not impossible to grasp the full significance of such figures as these. Perhaps the imagination might be assisted by supposing the whole state of Maine one immense corn field. It would require more than 4 such fields to equal the area mentioned. If the product of this vast tract were put in bushels baskets, and these baskets could be arranged in a line upon the equator, allowing 18 inches to a bushel, the line would extend around the earth 30 times, and would furnish 30 bushels of grain to every man woman and child in the United States.

Of course but a small fraction of this amount is utilized as human food. There are no reliable statistics to show how much is thus consumed, but it is doubtful if it exceeds one bushel in 50 of the total crop. Its use today is much more general in the South than in New England, where for the most part it is eaten only at irregular intervals as brown bread, johnny-cake, or occasionally as hominy. The colonists, following the example of the Indians, ate parched corn, either entire or in the form of a coarse meal. The virtues of this latter preparation, known as "no cake," have been highly extolled, and it seemed to fill the high position now occupied by the predigested cereal breakfast food. Other dishes which found favor with the colonists, composed wholly or in part of corn, were hominy, hasty pudding, johnny-cake, brown bread, pone, samp and succotash, the last consisting of green corn cooked with beans. Although wheat has so largely replaced corn, it may be questioned whether we cannot profitably make a fuller use of the cereal which seemed to conduce to both the physical and intellectual vigor of our forefathers.

Relative Composition of the Cereal Grains.

A statement of the comparative value of our foods requires the use of certain terms which may be briefly explained here.

Protein. Under the general name protein we include a number of bodies all of which contain nitrogen and most of which belong to the class known as proteids. These bodies possess a peculiar value in that they are absolutely necessary in our foods and cannot be replaced by any other class of compounds, although they may themselves replace to a large extent the fats

and carbohydrates. The fleshy part of the animal body consists largely of protein which can be formed only by the protein of the food. Hence the protein bodies are frequently spoken of as "flesh formers." As examples of protein may be mentioned the gluten of wheat, the curd of milk, and the white of eggs.

Fats or ether extract. Nearly all our foods contain a variable amount of fats and oils. These are readily soluble in ether which is usually employed in the chemical laboratories to remove these bodies. Since the ether also dissolves other bodies which may be present in small quantities, the term "ether extract" is frequently employed as a more exact term, though the shorter term "fats" is often used as being the more convenient. While these bodies possess great value as foods, they may be dispensed with, since the animal is able to form fats from both protein and carbohydrates. Fats are most abundant in the animal kingdom, although very few vegetable foods are entirely free from them.

Carbohydrates. These bodies are by far the most abundant in the vegetable kingdom, the amounts in our animal foods being too small to call for notice. The term includes the sugars and starches and also the woody matter of plants, or cellulose. The sugars are very readily digested as are the starches when properly cooked. The cellulose in the older plant tissues is not easily digested by man. This hardened cellulose constitutes the "crude fiber" of the chemist. The term nitrogen-free extract is often used to denote all the carbohydrates less the crude fiber.

Heat of combustion. The protein, fats, and carbohydrates, so far as they are digested, are all oxidized or burned in the animal body with the production of heat and body energy. The protein is not fully oxidized in the body, but produces, pound for pound, as much heat and energy as the carbohydrates. The fats are the greatest heat producers, yielding weight for weight, $2\frac{1}{4}$ times as much energy as the protein or carbohydrates. The heat of combustion of a food material is the heat produced by its oxidation. The energy thus developed is measured by calories, a calorie being the amount of heat required to raise one kilogram of water through one degree C., or about one pound through four degrees F.

The *ash or mineral matter* of a food is what remains behind after the oxidation is complete. Being already fully oxidized

it can furnish no energy, although the ash constituents may be absolutely essential to the animal.

In the table below is given the average composition of the principal cereals used for food. The analyses are quoted from Bul. 13, Part 9, Bureau of Chemistry, U. S. Department of Agriculture. With the exception of the rice, the analyses represent American grown grains.

Average composition of cereal grains.

	Water.	Protein.	Fat.	Crude fiber.	N-free extract.	Ash.	Heat of combustion.*
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cal. per lb.
Barley, unhulled	10.85	11.00	2.25	3.85	69.55	2.50	1735
Indian corn	10.75	10.00	4.25	1.75	71.75	1.50	1799
Oats, unhulled	10.00	12.00	4.50	12.00	58.00	3.50	1791
Rice, hulled	12.00	8.00	2.00	1.00	76.00	1.00	1716
Rye	10.50	12.25	1.50	2.10	71.75	1.90	1743
Wheat	10.60	12.25	1.75	2.40	71.25	1.75	1750

*Calculated.

From an inspection of the table it will be seen that of the six cereals considered, corn ranks fifth in the amount of protein which it contains, carrying only about four-fifths as much protein as wheat. On the other hand, with the single exception of oats, it contains far more fat than the other cereals and two and one-half times the quantity found in wheat. It is comparatively poor in fibre and ash, but leads in the heat of combustion, a fact that is due to the large proportion of fat which it carries.

Since the cereals are purchased for the most part in the form of flours or meals, comparisons based upon the relative composition of these products would be more valuable than those just made. In most of the digestion experiments carried out at this Station, Pillsbury's Best flour and a granulated corn meal have been used. In the following table the composition of these materials is compared with that of the original corn, with hominy, and also with meal prepared by the old process, still used in some sections of the country.

Average composition of corn products used in digestion experiments compared with wheat flour.

	Water.	Protein.	Fat.	CARBOHYDRATES. Crude fiber.	CARBOHYDRATES. N-free extract.	Ash.	Heat of combustion.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cal. per lb.
Corn	10.75	10.00	4.25	1.75	71.75	1.50	1796
Hominy	10.96	9.44	.67	.37	78.24	.32	1808
Corn meal, unbolted	10.30	7.50	4.20	65.90		1.20	1544
Corn meal, bolted	11.60	8.40	4.70	74.00		1.30	1728
Granulated meal	11.79	8.50	.98	.46	77.79	.48	1734
Granulated meal	7.77	8.69	1.92	.40	80.72	.50	1825
Wheat flour	11.09	11.37	1.33	.13	75.44	.64	1771

The corn meal formerly found upon the market consisted merely of unbolted ground corn, the composition of which was practically identical with that of the grain from which it was prepared. Such meal was commonly sifted before it was used, the bran and other coarse particles being thus removed. While such meal may still be found upon the market, being extensively used as food for stock, that used as a food for man is generally bolted before the meal leaves the mill, the offals or bran being sold as cattle food. Since the fat or oil, so abundant in corn, is confined largely to the germ, and since the oil is peculiarly subject to changes resulting in rancidity, the presence of the germ is predjudicial to the keeping qualities of the meal. This has lead to the production of the so-called granulated corn meal, obtained by the use of roller-mills. Instead of reducing the kernel to the desired fineness by a single operation, it is first crushed by a machine known as a degerminator which so loosens the germ and hull that they may be removed before the final grinding. It is evident that the composition of the product thus obtained will differ in several very important respects from that previously described, being poorer in fat, through loss of the germ, and also poor in crude fiber or woody matter, which is found for the most part in the rejected outer coating or the

bran. These differences are well shown in the above table. In the manufacture of hominy the germ is also removed, with marked effect upon the proportion of fat in the product. It will be noted that in the manufacture of both hominy and granulated corn meal two-thirds or more of the ash constituents are removed. While small amounts of these salts play a very important part in the animal economy, there is reason for believing that the most of our foods carry them in such large excess that the removal of a part of them in this case is no cause for uneasiness.

Digestibility of Corn Products.

The statement has been made that corn meal is less digestible than wheat flour; that our forefathers ate corn rather than wheat from necessity, and digested it because they could; whereas the present less stalwart generation digests corn less readily, and finding a better cereal at hand is wise in eschewing the first. As a part of the work of the nutrition division of the Office of Experiment Stations a number of digestion experiments with corn have been carried out at this Station. The reader is referred to a later publication of that office for details of this investigation. Only the general results with a brief outline of the methods employed are given here. The experiments were performed with human subjects, and were continued for periods of 6 days each. During this period each subject received daily weighed amounts of food of known composition. The feces corresponding to the food eaten were collected and analyzed. In similar experiments with cattle it is usually assumed that the difference in composition between the food and the feces proceeding from the same represents that part of the food which is utilized in the body; in other words, that the feces consist only of undigested food. In point of fact, this is not strictly correct, since we know that the feces consist not only of undigested food, but contain also small amounts of waste matters resulting from the natural wear of the body together with certain secretions, known to the physiological chemist as metabolic products, which have found their way into the intestines and have not been entirely reabsorbed, and which thus contribute to the volume of the feces. Sometimes, especially when the amount of food eaten is small, the error thus

introduced is too large to be ignored, particularly in the case of the protein. Several methods have been devised for correcting this error so far as it affects the protein, and such a correction has been applied in the results quoted beyond.

The corn products used in these experiments were hominy and granulated corn meal. The first was cooked in the usual manner and was eaten in one experiment with cream and sugar, in another experiment with a mixed diet, including bread, meat, canned peaches, butter, and sugar. The corn meal was eaten in the following forms: 1. Hasty pudding. 2. Johnny-cake. 3. Brown bread. 4. Hoe-cake. The hasty pudding was prepared by stirring the meal into salted water and cooking in a double boiler. In both johnny-cake and brown bread equal weights of meal and flour were used. The formulas used follow:

Formulas for johnny-cake, brown bread and hoe-cake.

	Johnny-cake.	Brown bread.	Hoe-cake.
	Grams.	Grams.	Grams.
Corn meal	100.0	100.0	100.0
Flour	100.0	100.0	....
Salt	5.0	4.0	5.0
Sugar	10.0	....	5.0
Baking powder	4.4	4.4	....
Molasses	....	40.0	....
Water	....	....	400.0
Milk	150.0	200.0	....

The brown bread was steamed in tin cans made for the purpose, somewhat conical in form, and provided with covers. Four loaves were cooked at once, the cans being immersed to half their depth in boiling water in a large pan having a perforated false bottom and a cover with a small opening. The loss by evaporation was very small, and the process, once in operation, required no further attention during the 4 hours allowed for the cooking.

Neither flour or baking powder were used in the preparation of the hoe-cake. The hot meal was stirred with boiling water until a thick pudding was formed, which was then spread in thin sheets upon the hot, well-greased iron plates and baked at once. In all the work care was taken to insure thorough cooking.

Average composition and heat of combustion of the corn meal and white flour breads used in the digestion experiments.

	Water.	Protein—(Nx6.25).	Ether extract.	Carbohydrates. Crude fiber.	Carbohydrates. N-free extract.	Ash.	Heat of combustion.
FRESH.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cal. cent.
Johnny-cake	29.4	7.8	2.2	.2	57.5	2.9	1384
Brown bread	43.9	6.3	2.1	.1	45.7	1.9	1119
Hoe-cake	52.8	4.0	.6	.2	40.0	2.4	886
White flour bread	40.7	6.9	.3	.1	49.8	2.2	1135
WATEE-FREE.							
Johnny-cake	....	11.3	3.0	.3	81.3	4.1	1960
Brown bread	....	11.1	3.7	.2	81.7	3.3	1994
Hoe-cake	....	8.4	1.2	.4	84.9	5.1	1874
White flour bread	....	11.7	.4	.1	84.1	3.7	1914

The compositions of the breads eaten is shown in the above table. It will be noted that the breads vary greatly in the proportion of water which they contain, with a less marked variation in the other ingredients. When these analyses are reduced to a water-free basis, as shown in the second part of the table, these differences become very much less. Thus, the dry matter of the johnny-cake has almost exactly the same composition as the dry matter of the brown bread, a fact that is not surprising when it is remembered that nearly the same formulas are used for both.

A wide difference in the protein contents between these breads and the white flour bread might have been looked for, since wheat flour is much richer in protein than corn meal. That so slight a difference exists must be attributed to the use of white

flour and milk in the preparation of the johnny-cake and brown bread, while the white bread was mixed with water. The hoe-cake carries much less protein than the other breads, neither white flour or milk being used in its preparation.

Since the differences in water content and the other differences resulting therefrom actually exist in the foods as eaten, the composition of the fresh materials is, after all, the matter of first importance. As eaten, the hoe-cake possessed only about two-thirds the food value of the johnny-cake and brown bread, while the last mentioned was distinctly inferior to johnny-cake in the amounts of nutrients which it contained. In practice it was found that the quantities of bread required and eaten were inversely proportional to the water content.

Several of the digestion experiments reported on the following pages were made with 2 subjects and most of them with 4. The results given in the table are the average of those thus obtained. With all the corn products a double series of trials was made, one with a " simple " the other with a " mixed " diet. In the case of the hominy and hasty pudding the simple diet consisted of the products named with milk and sugar as accessory foods. With johnny-cake, brown bread and hoe-cake, butter was used in addition to the above. The mixed diet included meat and canned peaches. The men enjoyed excellent health throughout the investigation, and while the diet at times proved monotonous, they retained good appetites throughout the experiment.

The results of these experiments are given in the table on the following page. The digestibility of the protein is shown in the first two columns, in the second of which corrections for metabolic products have been applied, as explained on page 91 While it is not claimed that the method adopted for this purpose gives absolutely correct results, there can be no doubt that the corrected figures furnish a more accurate idea of the food value of these materials, and in the discussion which follows these results only will be considered.

Digestibility of nutrients and energy of total food.

	Protein. Not corrected for metabolic products.	Protein. Corrected for metabolic products.	Carbohydrates.	Heat of combustion.
	Per cent.	Per cent.	Per cent.	Per cent.
Hominy, simple diet	83.6	89.2	99.0	96.4
mixed diet	88.9	93.6	98.8	96.3
Hasty pudding, simple diet	82.3	89.2	99.0	95.9
mixed diet	89.0	94.0	98.9	96.9
Johnny-cake, simple diet	89.6	94.9	98.7	93.8
mixed diet	90.1	94.8	99.3	93.9
Brown bread, simple diet	87.4	94.7	98.7	93.5
mixed diet	89.5	95.5	99.4	92.9
Hoe-cake, simple diet	87.0	93.9	98.7	93.7
with syrup	84.4	92.6	99.2	95.5
mixed diet	90.0	94.6	98.8	92.6
White bread, simple diet	89.2	94.0	98.9	94.0
mixed diet	92.6	96.1	99.0	98.2

Discussion of the Results Obtained by the Digestion Experiments.

1. In every case but one, the protein of the mixed diet was more completely digested than that of the simple diet. The low digestibility of a simple diet has been often noted in previous experiments.

2. With a simple diet the protein of the johnny-cake and the brown bread seems to have been slightly more digestible than that of the white bread. With the mixed diet, the white bread shows a digestibility distinctly greater than that of the corn breads.

3. The use of syrup with the hoe-cake to a slight degree depressed the digestibility of the protein. This is in accordance with other experiments in which the digestibility of the protein apparently varied with the ratio existing between the protein and the other nutrients.

In this connection attention may be called to the large proportion of carbohydrates in the food used in this work. The requirements of the body seem to be most economically met by

a selection of foods supplying protein, carbohydrates, and fat in certain proportions, although the two latter classes of nutrients may replace each other to a considerable extent, a pound of fat supplying about as much energy as 2¼ pounds of carbohydrates. The proportions generally accepted as well adapted for an average person of active habits are one of protein to 5 or 6 of carbohydrates or the equivalent in fat. The proportions as found in the food of these experiments are shown in the table below.

Ratio between the protein, carbohydrates, and fat of food, one part of fat being considered as equivalent to 2¼ parts of carbohydrates.*

	Simple diet.	Mixed diet.	Simple diet with syrup.
Hominy	1:13.1	1:6.8	
Hasty pudding	1:11.8	1:7.3	
White bread	1:8.8	1:6.0	
Johnny cake	1:8.3	1:6.9	
Brown bread	1:8.5	1:6.9	
Hoe cake	1:9.7	1:6.9	1:15.4

*This is not quite the same as the "nutritive ratio" of stock feeders, which is based upon the digestible nutrients only.

With the simple diet, consisting largely of corn relatively low in protein, the ratio is much wider than the standard mentioned, ranging from 1 : 8 to 1 : 13. With the mixed diet, containing meat, which is rich in protein, the ratio was narrowed to about 1 : 7. On the other hand, by the addition of syrup to the simple hoe-cake diet, a ratio originally too wide became still wider, 1 : 15.4, and the digestibility of the protein suffered.

4. From an inspection of the carbohydrate column it is difficult to draw any conclusion farther than that the carbohydrates are almost completely utilized in the body, whether they are derived from white bread or from any of the corn foods studied. The results shown in the last column are even less conclusive and seem to follow no discoverable law.

The figures already quoted relate to the total food eaten. By many experiments the digestibility of such simple articles of food as milk, butter and sugar has already been determined.

By accepting these factors and applying them to the accessory foods of a simple diet, it is possible to caluculate the digestibility of the cereal itself. The figures given in the next table were thus obtained.

Digestibility of nutrients and energy of corn preparations alone.

	Protein.		Carbohydrates.	Heat of combustion.
	Not corrected for metabolic products.	Corrected for metabolic products.		
	Per cent.	Per cent.	Per cent.	Per cent.
Hominy	74.5	84.3	98.2	94.4
Hasty pudding	73.2	83.9	98.3	93.1
Johnny-cake	86.3	93.2	98.9	93.5
Brown bread	83.0	92.8	98.6	93.4
Hoe-cake	77.1	88.9	98.6	93.8
Hoe-cake with syrup	78.8	90.0	98.7	94.0
White flour bread	85.6	89.8	98.9	94.0

A comparison of this table with that given on page 95 indicates that these corn foods are either considerably less digestible than the other foods with which they were eaten, or they themselves become more digestible when eaten with other foods. Similar results obtained with other experiments in which certain foods were eaten both singly and with a mixed diet indicate that the second conclusion is the correct one.

A Balanced Diet.

Attention has been called to the fact that in most of the experiments here reported the diet adopted was one-sided, i. e., the proportion of protein to the fats and carbohydrates was too small. This is so common an error in diet that it may be proper to mention a few of the ways in which it may be corrected. It is evident that Indian corn in itself is too poor in protein to form a large part of the diet unless special pains are taken to maintain the proper balance. This may be done in several ways. By the addition of meats, fish, eggs, or vegetable

foods rich in protein, such as beans or peas, the balance may be restored. The same result may be accomplished by the free use of milk instead of water in the preparation of corn foods. The value of milk in thus furnishing protein is not so fully appreciated as it should be. A quart of whole milk carries more protein than one-third of a pound of beef found. Skim milk is both better and cheaper for this purpose, since it carries a slightly higher percentage of protein than whole milk, and contains very little fat. Two quarts of skim milk, costing but 5 cents, furnish nearly as much protein as a pound of beef round, and more real nutriment than a quart of oysters costing 35 or 40 cents. Yet the skim milk is too frequently wasted or fed to calves and pigs. The intelligent housewife may easily find a hundred ways in which this valuable by product could be more directly and profitably utilized as a food for man.

The use of large amounts of butter, pork, or other fatty foods in connection with corn foods is to be deprecated, since the difficulties in the way of establishing a proper balance between the protein and other nutrients is thus increased. The effect of syrup in depressing the digestibility of protein has already been alluded to. Sugar and molasses are open to the same objection and for the same reason. The craving for these food accessories is an example of the fact that the appetite is not always a safe guide.

The coarsely milled forms in which corn is placed upon the market naturally call for more prolonged cooking, not only to break down the starch grains, but to rupture the walls of the cells and thus expose their contents to the action of the digestive juices. It is probable that much of the difficulty occasionally experienced in digesting corn breads might be avoided by a careful attention to these facts. At present there is but little difference to the consumer in the retail cost of corn meal and wheat flour. Both are among the cheapest of our foods. The question of economy need not be considered in choosing between the corn and wheat breads. In general it may be said that the corn products are more digestible than is commonly supposed. Not only their digestibility, but their cheapness and the readiness with which they may be converted into palatable foods suggest a more extended use and entitle them to a much higher place in the popular estimation.

DIGESTION EXPERIMENTS WITH CHESTNUTS.

L. H. MERRILL.

A few years ago this Station made quite a study of the nutritive value of nuts, the results of which were published in Bulletin No. 54.* At that time it was planned, as part of the nutrition investigations in cooperation with the U. S. Department of Agriculture, to make digestion experiments with mixed diets in which nuts should form an important part of the food consumed. Only two such experiments with chestnuts were made. The results have been held unpublished hoping that opportunity would come to add to the number of experiments with chestnuts, and also with other nuts.

As shown in the following table, chestnuts differ materially from most other nuts in carrying large amounts of carbohydrates, but little fat, and for the most part relatively small amounts of protein. In fact, they more nearly resemble Indian corn in composition than ordinary nuts.

The dry matter of the meats (kernels) of chestnuts compared with the meats of other nuts † and with corn meal.

	Protein.	Fat.	Carbohydrates.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.
Almonds	22.1	57.6	18.2	2.1
Filberts	16.2	67.8	13.5	2.5
Pecans	10.6	72.9	14.7	1.8
Walnuts	17.2	66.3	15.2	1.3
Chestnuts	11.3	11.0	75.2	2.5
Corn	11.2	4.8	82.4	1.7

*Nuts as Food, Bul. 54, Maine Agricultural Experiment Station, 1899.
†Analyses taken from Bulletin 54 of this Station.

THE EXPERIMENTS HERE REPORTED.

In the experiments a mixed diet was used in which chestnut flour made a prominent part. Each subject consumed daily 300 grams of the chestnut flour, which furnished about one-fifth of the proteids, one-half of the fat, nearly one-half of the carbohydrates and three-eighths of the total fuel value of the food.

In the table which follows, there is given the chemical composition of the food materials used. The chestnut flour was prepared by shelling the nuts, which were then partly dried and blanched by 20 to 30 seconds immersion in boiling water, again dried, and ground. The bread was made from a straight flour from Northwestern grown wheat. The whole milk was drunk at the meals and the skim milk was used in making the bread. The chestnut flour was eaten as mush.

The details of the experiment are given in the tables on page 101.

Percentage composition of the chestnuts from which the flour was made and of food materials used in the digestion experiments here reported, and heats of combustion per gram, calculated to water content at time when used.

Laboratory number.	Experiment number.	Material.	Water.	Nitrogen.	Protein.	Fat.	Carbohydrates.	Ash.	Heats of combustion. Determined.
			%	%	%	%	%	%	Cal.*
6393..	......	Whole nuts....................	40.00	......	3.40	1.90	42.50	1.20	2.120
6393..	......	Kernels (meats flesh)	44.89	......	3.85	2.10	47.75	1.41	2.372
6416..	39-40	Chestnut flour	6.36	1.02	6.38	3.32	81.54	2.40	3.958
6417..	39	Bread..........................	35.39	1.73	10.81	.52	51.28	2.00	2.799
6418..	40	Bread..	38.65	1.64	10.23	.49	48.55	2.08	2.639
6374..	39-40	Potato	75.46	.37	2.32	.20	21.02	1.00	1.002
6420..	39-40	Milk	87.63	.57	3.56	3.29	4.84	.68	.732
6419..	39-40	Skim milk.....................	90.37	.62	3.88	.48	4.61	.66	.436
6421..	39	Feces	6.17	6.35	39.69	12.15	27.23	14.78	5.132
6422..	40	Feces	6.19	6.16	38.50	11.28	25.85	18.18	4.775

* Calories per gram.

DIGESTION EXPERIMENT No. 39.

Kinds of food: Chestnut flour, bread, potatoes and milk.
Subject: E. R. M. Age 23 years.
Weight (without clothes): At beginning 136.7 lbs., at close 134.1 lbs.
Duration: 3 days, 9 meals.

Laboratory Number.		Weight of material—Grams.	Total organic matter—Grams.	Protein N x 6.25—Grams.	Fat—Grams.	Carbo-hydrates—Grams.	Ash—Grams.	Heat of combustion—Calories.
6416	Chestnut flour..........	900.0	821.2	57.4	29.9	733.9	21.6	3562
6417	Bread	1275.0	798.3	137.9	6.6	653.8	25.5	3569
6374	Potatoes	40.0	9.4	.9	.1	8.4	.4	40
6420	Milk	150.0	17.5	5.3	4.9	7.3	1.0	110
6419	Skim milk	2700.0	242.1	104.6	13.0	124.5	17.8	1177
	Sugar....................	100.0	100.0	....	....	100.0	....	396
	Total	....	1988.5	306.1	54.5	1627.9	66.3	8854
	Feces..................	....	93 0	46.7	14.3	32.0	17.4	604
	Estimated feces from food other than chestnuts	....	24.2	13.2	.4	10.6	....	120
	Estimated feces from chestnuts	....	68.8	33.5	13.9	21.4	....	484
	Total amount digested	....	1895.1	259.4	40.2	1595.9	48.9	8250
	Estimated digestible nutrients in chestnuts	....	752.4	23.9	16.0	712.5	....	3078
		%	%	%	%	%	%	%
	Co-efficients of digestibility of total food...	....	95.3	84.7	73.8	98.0	73.8	(93.2)
	Estimated co-efficients of digestibility of chestnuts alone	....	91.6	41.6	53.5	97.1	....	(86.4)

DIGESTION EXPERIMENT No. 40.

Kind of food: Chestnut flour, bread, potatoes, and milk.
Subject: H. A. M. Age, 34 years.
Weight (without clothes); at beginning 130.7 lbs.; at close 129.3 lbs.
Duration: 3 days, 9 meals.

6416	Chestnut flour..........	900.0	821.2	57.4	29.9	733.9	21.6	3562
4618	Bread	1275.0	755.7	130.5	6.2	619.0	26.5	3365
6374	Potatoes	40.0	9.4	.9	.1	8.4	.4	40
6420	Milk	150.0	17.5	5.3	4.9	7.3	1.0	110
6419	Skim milk	2700.0	242.1	104.6	13.0	124.5	17.8	1177
	Sugar..................	100.0	100.0	....	....	100.0	....	396
	Total	....	1945.9	298.7	54.1	1593.1	67.3	8850
	Feces..................	....	59.1	30.1	8.8	20.2	14.2	373
	Estimated feces from food other than chestnuts	....	23.2	12.6	.4	10.2	....	114
	Estimated feces from chestnuts	....	35.9	17.5	8.4	10.0	....	259
	Total amount digested	....	1886.8	268.6	45.3	1572.9	53.1	8477
	Estimated digestible nutrients in chestnuts	....	785.3	39.9	21.5	723.9	....	3303
		%	%	%	%	%	%	%
	Co-efficients of digestibility of total food...	....	97.0	89.9	83.7	98.7	78.	(92.7)
	Estimated co-efficients of digestibility of chestnuts alone	....	98.1	69.5	71.9	98.6	....	(92.2)

PLANT BREEDING IN ITS RELATION TO AMERICAN POMOLOGY.

W. M. MUNSON.

The whole question of plant and animal breeding is in a state of transition, for, with a sudden interest in Mendel's work, and the generalizations of DeVries and others, investigations in breeding are taking a new direction, not necessarily less practical in final results, but at present less comprehensible to the average man. It has therefore seemed worth while to give a brief statement of methods heretofore employed in plant breeding, in their relation to the development of American fruits, and a summary of the results already accomplished.

The breeding of plants, as of animals, is quite as much a question of culture, care and selection, as it is the production of a departure from a given type. Most plants live an indifferent existence, dependent very closely upon immediate conditions of environment. Furthermore, every part of a plant lives largely for itself and is capable of propagating and multiplying itself if removed from the parent plant. This fact increases the importance of suitable environment, and of a knowledge of methods of propagation on the part of one who is to undertake systematic breeding. In the study of plant breeding then, for all practical purposes, the unit is the embryo individual plant, whether in the form of a seed or a bud. While in the light of recent investigations this statement may be regarded as somewhat antiquated, the writer would still maintain the position that in the prosecution of the practical improvement of the American fruits, this proposition will hold. Of course in the scientific investigation of the principles of plant breeding, embryological conditions are of importance.

In recent times the student of plant breeding thinks that he has a key to the laws of plant variation in the so-called "Mendel's Law," and there are many facts which tend to strengthen

that belief, but a discussion of that subject is not intended at this time.

Beginning of Systematic Breeding of Fruits

One of the most significant facts in nature is that every species of plant which man has cultivated for any length of time has numerous forms, varieties, or strains. The practical horticulturist selects that form or strain which is best for certain purposes or for certain conditions. The plant breeder asks why or how these forms came about and how they can be improved. It is worthy of note, however, that until about a century ago the principal studies of plant life were made from wild forms rather than from domesticated species.

THE WORK OF VAN MONS.

The man who first propounded a theory of the philosophy of the origin of varieties of cultivated plants, was Jean Baptiste Van Mons, who was born in Brussels, in 1765, and died in 1842. Van Mons was by profession a chemist, and horticulture was his avocation. His theory applied particularly to fruit trees, but he held that the principles he set forth are of general application in the vegetable kingdom.

Van Mons' theory may be briefly epitomized as follows: All fine fruits are artificial products. There is always a tendency in all varieties of fruit trees to return, by their seeds, towards a wild state. This tendency is most strongly shown in the seeds borne by old fruit trees. On the other hand, the seeds of a young fruit tree of a good sort, being itself in a state of amelioration, have the least tendency to retrograde, and are most likely to produce improved sorts. Finally, there is a limit to perfection in fruits. When this point is reached, as in the finest varieties, the next generation will more probably produce poorer fruits than if reared from seeds of an indifferent variety in the course of amelioration.

This system or theory was not founded upon experience or practice, but was a preconceived idea of the author, who spent fifty years, with all the zeal of an enthusiast, in an attempt to prove his theory. He began his work by gathering seeds from a young seedling tree without paying much attention to its quality except that it must be in a state of variation. The seed-

lings were planted closely in nursery rows and often checked by pruning, with the thought that to improve the fruit the original rank growth of the tree must be subdued or enfeebled. From the first fruits produced, and the fruit was always gathered before it was fully ripened, seeds were saved and sown again; and this practice was continued generation after generation. The whole process was, to use his own words: "To sow, to re-sow, to sow again, to sow perpetually; in short to do nothing but sow is the practice to be pursued and which cannot be departed from." Van Mons' work, which was largely confined to pears, was begun in 1785. Thirty years later, in 1823, when he had commenced distributing scions freely throughout the world, he had 80,000 seedling trees in his nursery. At this time his first catalogue was issued and in it 1050 pears are mentioned by name or number. Of this list 405 were his own creation and 200 of them had been considered worthy of naming, among them being some of the varieties which are still raised the world over, including Diel, Bosc, Colmar, Manning's Elizabeth, and many others of equal merit. Many of these varieties found their way into America, chiefly through the efforts of Robert Manning of Massachusetts.

Whatever may be thought as to his theories, there is no doubt that Van Mons accomplished more than any other single individual up to the middle of the nineteenth century in breeding new and valuable fruits. Without discussing the principles for the establishment of which Van Mons was working, it is enough to say that in some of his series the generations came into bearing earlier and earlier until in the fifth generations of certain pears, he was able to secure fruit at 3 years from seed. As already intimated, however, this was at least partly brought about by the system of enfeebling and consequent encouragement of the habits of precocity, and by cumulative selection. Probably no worker with plants has ever given to the world so clear a demonstration of the value of selection as Van Mons; and this demonstration is worth all of the efforts put forth, even though this was made in the attempt to prove another and, as is now believed, erroneous doctrine.

WORK OF THOMAS ANDREW KNIGHT.

Contemporaneous with Van Mons, was Thomas Andrew Knight, often referred to as the father of modern horticulture; a man whose work as a careful, accurate, scientific investigator of the phenomena of plant life, especially in its economic relations, is unrivaled even at the present time, and whose opinions upon the studies of crossing and of plant development were of the utmost importance. Knight was born in England in 1759 and died in 1838. His investigations of problems in physiological botany have become classic and he brought the same energy and thoroughness to his investigations of horticultural problems. He gave particular attention to the physiology and methods of crossing plants and was the first to perfect the method of root grafting,* but his greatest work was in the direction of the improvement of cultivated plants, by breeding. He took up the question of the running out of varieties and made great efforts to produce new ones. He was confronted by the same problems which appealed to Van Mons, but he approached the subject in a very different way. Knight asked direct questions of nature, and never arrived at a general theory of the improvement of plants, although he was not without hypotheses concerning the phenomena he was studying.

Van Mons, as noted, was the first to demonstrate the importance of selection in the improvement of plants; Knight was the first to show the value of crossing for the same purpose. As early as 1806 he wrote: "New varieties of species of fruit will generally be better obtained by introducing the farina of one variety of fruit into the blossoms of another, than by propagating any from a single kind."† The varieties which he raised, largely by means of crossing, included apples, pears, plums, peaches, cherries and strawberries, as well as many vegetables such as potatoes, peas, cabbages and others; but more important than the new fruits, which were of immediate and so-called practical value, was the contribution to the general knowledge of plant life, and of the methods to be employed in amelioration, which Knight gave freely for the benefit of all mankind.

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* See Transactions of London Horticultural Society.

† Ibid. Vol. 1, p. 38, 1806.

Such, in brief, are the beginnings of the science of plant breeding, as exemplified in the amelioration of domesticated fruits. Early in the nineteenth century the more advanced horticulturists were awakening to the fact that plants as well as animals are capable of improvement by systematic breeding. As the years have gone on, knowledge of the factors involved, and of methods of procedure, has increased, with the result that a new horticulture has developed in this country. European varieties and European methods of culture have been superseded by varieties and methods of American origin,—varieties and methods better suited to the very different climatic conditions and to popular demands.

The Development of American Pomology.

The records of early attempts at fruit growing in America are mostly records of failure. The varieties first grown were naturally those brought from Europe, and though in the beginning of the last century American seedlings were beginning to attract attention, still the chief effort to extend the range of culture was by the introduction of new varieties from Europe. This was the only way known of securing new sorts.* In 1830, in a letter to Gen. Dearborn, William Kenrick says: "From among 150 varieties imported into Boston by Eben Preble about 1805, the only additions to desirable kinds were two cherries, the Black Tartarian and the White Tartarian, and a single pear." † If fruit culture in this country were limited to the varieties which have come from Europe, it would be of very small proportions. At the present time, while agents of the Government are scouring the world for new species and varieties, plant introduction is very largely looked upon merely as a means to an end. Russian, Chinese and Japanese fruits are being freely introduced, not merely for their intrinsic merit, and in the hope that they may thrive in their new environment, but with the idea that from hybrids between them and the native species, and from American grown seedlings of these imported species, valuable sorts may be obtained.

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* An interesting study in this connection is that of the development of the native grape.—See Bailey' Evolution of our Native Fruits.

† Manning, History of Massachusetts Horticultural Society, p. 42.

CHANCE SEEDLINGS.

In the development of American pomology the first step was a sort of crude selection of chance seedlings, wherever these might be found. The importance of having varieties adapted to existing conditions was early understood, but the question of how to get them was the trying one. It is a notable fact that many of the varieties which today stand out as landmarks, were accidental seedlings or chance discoveries of valuable wild forms.

Among the more prominent American fruit originating in this way may be mentioned the Alexander or Cape grape, which first introduced successful grape culture into Eastern America; the Catawba, still a popular grape; the Dorchester and Lawton blackberries; Seckel pear; Wealthy apple; and many of the best raspberries, gooseberries, cranberries and plums.

SELECTION.

The next step in the improvement of fruits was the selection of parents from which to grow seedlings. The importance of the work Van Mons was doing in Belgium, in emphasizing the principle of selection, has been noted above, but American horticulturists soon outstripped their teacher. In 1882 James Thatcher, in his American Orchardist, made recommendations which today would be regarded as much better than those of Van Mons. He says: "The seeds for planting should always be selected from the most highly cultivated fruit and the fairest and ripest specimens of such variety." William Kenrick, a nurseryman of Roxbury, Mass., was more conservative and inclined to adopt the theory of the natural deterioration of varieties,* at the same time giving in detail the methods practiced by the great European plant breeder, as already described.

A few examples of fruit originating from seed of carefully selected parents will suffice. Diana, early recognized as a valuable child of Catawba; Moore's Early, Worden, Pocklington and the other numerous progeny of Concord, among grapes; Shiawassee, Princess Louise and McIntosh, as seedlings of the Fameuse apple, as well as the numerous offspring of Oldenburg, Rhode Island Greening and others; the seedlings

* Kenrick's New American Orchardist, pp. 24-32.

of Green Gage plum; the Tartarian cherries; and the Crawford peaches are familiar cases in point. But of the immense number of seedlings produced in this rather haphazard way, very few have been found of superior merit. Improvement by selection, in the strictest sense, has been employed most successfully with annual plants, and the methods used have been gradually perfected. In the choice of the foundation stock, however, the same principles are involved in breeding fruits as in the production of choice wheat, corn or cotton, namely; Select parents from stock grown in a locality likely to produce vigorous, hardy plants, and choose individuals of special merit in some particular direction. In the improvement of grapes, many failures have resulted from the choice of tender varieties as parents, although the quality of fruit was greatly improved. In the work of adapting fruits to different climatic conditions of the states west of Lake Michigan, little real progress was made until the introduction of Russian and other so-called iron-clad varieties as parent stock. The seedlings from varieties grown in Western Europe or Eastern America were entirely unsuited to the new conditions.

Having the stock from a suitable locality, it is of the highest importance that the individual parent from which seedlings are to be raised shall be the very best of its kind. In working for size in fruit, it is not enough that a plant shall produce one or two abnormally large specimens, but that plants producing a large number of uniformly large specimens should be chosen. In other words, the parent plant should possess in the highest degree the qualities of the ideal form sought, a principle directly contrary to that originally taught by the apostle of selection.

CROSSING.

Cross-fertilization and hybridization were little used in the improvement of plants during the first half of the last century. Knight had shown what might be done, and he had many followers in this country, but the opinion of Van Mons, strengthened by the indisputable array of choice fruits he had obtained as a result of selection, was almost equally strong. In 1836 A. J. Downing wrote: "Assuming Professor Van Mons to be strictly correct, we would suggest that a great saving of time,

and a considerable improvement in quality and vigor, might be gained by calling in cross-fertilization to the aid of the cultivator as soon as the fruit of the trees (say the second generation) begins to show symptoms of amelioration. By impregnating them with pollen of the finest varieties we conceive that the next generation would produce excellent fruit and at a saving of twenty or thirty years."*

In 1844, C. M. Hovey, one of the most successful of the earlier plant breeders, definitely championed the cause of cross-fertilization on the ground that "the results will be obtained in a shorter period and, we believe, equally as favorable as by the method of successive generations alone." Mr. Hovey spoke from experience, his first cross-bred strawberry seedling having been brought to notice in 1838. The striking successes of Hovey, Allen, Downing, and others, soon led to the general adoption of cross-fertilization as a method in the improvement of fruits, and for the last half century the advance has been in the minor factors and not in a better understanding of principles. Up to the present time the question of dominant and recessive characters, as developed in the offspring of crosses, has had very little bearing upon the status of American pomology.

The early hybridizers often used a mixture of pollen, believing that it was possible for the same seed to be influenced by pollen from two different sources, and the possibility of superfœtation was often discussed. The Duchess grape is a result of one of these mixed crosses. This was produced by Caywood "by crossing a White Concord seedling with Delaware or Walter, the pollen of both being applied at the same time."*

One breeder of grapes claimed to produce his new varieties by a new and very simple process, namely by diluting the pollen of the male flower with rain water and then applying it to the pistils of the variety selected as the female parent.†

As a knowledge of the process of fecundation became more clear, other methods of securing desired combinations were adopted and compound hybrids or derivative hybrids became common. Some of the best results have been obtained by such combinations; for example the Brighton grape, which is a

* Bushberg Catalogue, 3rd edition, p. 94.

† Ibid, p. 118.

cross between Diana-Hamburg and a seedling of Concord. The method of using what Webber has called "dilute hybrids" has also been employed with success, particularly in the fixation of types.

THE LIMITS OF CROSSING.

"Crossing is useful as a means of originating new forms adapted to man's special uses and also as a means of revitalizing the offspring by providing new combinations of characters which may better enable the individual to compete in the struggle for existence; but there are limits beyond which crossing is useful neither to the species nor to man."‡

Without discussing this subject at length, it may be said that, within certain limits, the wider the divergence of the parents in any fertile cross, the more vigorous the progeny. This statement rests on the broad basis of fact, and is corroborated by the work of Darwin and others down to the present day. Nature has comparatively few varieties, the initial variation being usually crowded out in the fierce struggle for existence; but among cultivated plants instead of struggle for existence and the survival of the strongest, we have a struggle for improvement and a "survival of the most coveted." Weeds are best fitted to survive, but the hoe and the cultivator enable the weaker and, for man, the more desirable species to prevail.

So then cultivated plants, leading a life of comparative peace, expend their energies along the lines which are laid down by man. Variations appear and are carefully watched, guarded, and propagated; with the result that in time a new type or variety is produced. But the conditions are vastly more variable than are those under which their wild allies are growing. This leads to a wide range of characteristics found in the same variety, consequently unions are here more powerful than in the wild state, and the expert plant breeder is he who manipulates these forces and their combinations to the best advantage. In the past history of plant breeding this manipulation has necessarily been carried on more or less blindly, but the work of Mendel, DeVries and others seems to open wonderful possibilities in this direction.

‡ Bailey, Philosophy of Crossing Plants.

THE INFLUENCE OF THE SOIL.

One of the most commonly recognized factors in environment is that of soil conditions. It has been observed by tomato growers, and is commonly taught, that more fruit is obtained on relatively poor soil than on rich.* It should be borne in mind, however, that this increased fruitfulness—at least in the case of the tomato—is relative rather than absolute; that while the proportion of vine is greater on rich soil, the actual amount of fruit is also much greater, and the individual fruits are larger and fairer.†

With this supposition in view, some have thought to produce fruitful varieties by a process of selection and the transmission of the characters of fruitfulness thus acquired. Certain of the small fruits are known to flourish on particular soils or under definite conditions and nowhere else. Particularly is this true of the strawberry, the raspberry and some grapes.

THE USE OF THE UNRIPE SEED.

As a means of checking too vigorous growth and increasing fruitfulness, the method of using immature seed has been employed with a certain measure of success. It has been found that the use of immature seed increases the productive parts at the expense of the vegetative and thus it comes about that more fruit is formed in proportion to the foliage than is normal. In a series of experiments conducted through several generations by Goff and Arthur,‡ it was found that a tomato plant selected as a representative of the series grown from unripe seed bore 3½ pounds of fruit to one pound of vine (leaves, stems and roots taken together); while a plant of the same variety grown each year under the same conditions but always from ripe seed gave only 1⅛ pounds of fruit for every pound of vine. We have here then an enormous relative increase of fruitage from unripe seed which in fact "was quite apparent to the casual observer upon looking at the plants of the two series as they grew in the garden, although it required the scales to disclose how surpris-

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* Allen, American Garden, Vol. 11, p. 358, 1890.

† Cornell Experiment Station, Bul. 10, 1889; also Ibid., Bul. 21, 1890.

‡ American Naturalist, Vol. 29, p. 905, 1895; also Rpt. Wis. Expt. Station, 8, pp. 152-9, 1891.

ingly great the difference was."* It may be well to note also that, associated with the increase in the amount of fruit, there was also an increase in the number of individual fruits, although these, as also the seed, were individually smaller. Van Mons also employed this method of using unripe seeds in his experiments with apples and pears, for the purpose of checking too vigorous growth and increasing the relative fruitfulness of the product.

Besides increasing the number of fruits, the use of unripe seed also results in early maturity. In the cumulative trials of tomatoes, already mentioned, the strain from immature seed ripened from 10 days to 4 weeks earlier, in different years, than did the corresponding series from ripe seed. Such differences in earliness do not always occur, however, and some observers have noted opposite results; but with the earlier production and the increased percentage of fruit comes also the lowering of vitality and consequent lessened ability to stand unfavorable conditions. In other words, the use of unripe seed is simply a means of checking growth and the usual result follows. Within certain limits checking growth tends to increase fruitfulness, no matter how the check is given. Some have contended that the plants would overcome the initial weakening and upon being subjected to favorable conditions would acquire vigorous growth while retaining the more fruitful habit. Of course this is the end desired as a result of this method of treatment, but, so far as the writer is aware, there is nothing to warrant such a supposition. Experience in breeding tomatoes at this Experiment Station indicates that this desired end is not obtained.

BREEDING FROM ASEXUAL PARTS

The distinction between seedling varieties and bud varieties is one of degree rather than of kind. The different buds on a tree frequently produce offspring possessing quite as distinct individuality as do the different seedlings from the same tree. So the tree should be considered not as an individual but rather as a collection of individuals, the bud being the unit. Now no two buds on a given tree are subjected to precisely the same conditions. All of the buds cannot possibly survive, hence arises

* Arthur, American Naturalist, 29, p. 906.

a constant and intense struggle for existence. Owing to the different conditions of light, air, food, and room for extension, some branches will be large and vigorous, others will be small and weak; some will produce fruit freely, others will be barren. In the same way, no two fruits are ever exactly alike. Some will be large, others small; some roundish, some oblong; some highly colored and of good flavor; others pale and insipid.

This fact of the universality of bud varieties, together with the fact that variations may be perpetuated by asexual means is of the utmost importance in practical horticulture and in the systematic improvement of fruits and vegetables. The practical fruit grower knows that some trees never bear any fruit and that others of the same kind bear abundantly; that some Baldwins and Spys are habitually large, and others habitually small and unsatisfactory, and these observations are borne out by the records of the Station orchard. Upon close examination of the branches of an individual tree, through a series of years, the same phenomena would be found to exist in individual branches. A very good illustration of the case in point is that of a currant plantation cited by Powell.* A plantation of Fay currants containing some 12,000 bushes came directly or indirectly, through cuttings, from 25 selected plants, purchased when the variety was first introduced. The original plants were uniform in size and very productive. In the haste for a large number of plants the new wood was cut from these bushes every fall, and when more bushes were established they in turn were divided into cuttings as often as new wood was made. Little attention was paid to the bearing capacity of the bushes in later generations because of the excellent character of the original stock. As a result of this lack of attention, at the end of 12 years some of the bushes were found to be heavy bearers, others very light bearers and others almost barren. How this came about is readily seen, and the remedy is equally obvious. If a single bud produces a branch which is barren, or nearly so, and that branch happens to be taken as a cutting, naturally a barren bush results. If this bush, before its character is determined, is used for cuttings, the tendency is perpetuated and an ever increasing series of worthless plants is established.

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* American Garden, 1898, p. 466.

Some of the numerous examples of bud variations in apples, pears and other fruits will suggest themselves. In Virginia, Albermarle Pippin is a familiar example of bud variation from the Yellow Newtown. In Canada the Red Gravenstein appears. In the Northwestern states, King is hardly recognized because of its elongated form. The propagator has only to form a clear idea of the type of Baldwin, Newtown, King, or other fruit which he wishes to attain, then to select from each generation buds from branches which appear most nearly approximating his ideal. If then the differences in the buds of a tree or other fruit plant can be perpetuated by asexual means, as by cutting, grafting, etc., it is evident that this method can be depended upon for the systematic improvement of existing varieties; and with most of the commonly cultivated fruits such improvement is vastly more important than a wholesale production of new forms.

The improvement of horticultural varieties does not necessarily follow the lines of improvement in the wild state. Nature builds up her types gradually by the selection, in each generation, of individuals best suited to their environment; in other words by a "survival of the fittest," or, as Bailey puts it, a "survival of the unlike." Man, on the other hand, selects the most coveted, and in order to attain his end supplies the environment best suited to the individual, and with the natural result.

While recognizing and emphasizing the importance of the production of seedlings from judicious crossing, it is believed by the writer that the attention to conditions of environment is infinitely more important than the multiplication of forms, in which the element of chance plays so large a part, and that, unfortunately, in many cases, the principles of selection and asexual propagation have in the past been lost sight of.

The slight differences which any careful observer will detect in the common fruits form sufficient basis for the most favorable of systematic breeding. A few examples of fruit originating in this way will suffice. The origin of the Nectarine as a bud variation of the peach is familiar. Even at the present day such variations are not uncommon. Thomas Andrew Knight records the case of a Yellow Magnum Bonum plum producing a branch which bore Red Magnum Bonum.* Powell cites a

* Cf. Darwin, Animals and Plants Under Domestication.

recent case of bud variation in which a tree of Coe's Golden Drop has produced a branch which for several years has borne red fruit. In every way except color both trees and fruit are identical with Golden Drop. In California, in an Isabella vineyard belonging to J. F. Pierce of Santa Clara, several vines sported in 1882. The fruit of these sports was very much sweeter and altogether superior to the parent variety. It shows no tendency to reversion and is now extensively grown in California under the name of Pierce, bringing a higher price than any other of the American types. It is interesting to note, too, that the Pierce is capable of reproducing itself from seed, thus becoming the first of a race of native grapes.* The grape is prone to bud variations and it is not uncommon to see a branch bearing fruit which differs in size, color or flavor from that of the remainder of the plant. The Golden Queen raspberry originated as a sport from Cuthbert, formerly called Queen of the Market, on the grounds of Ezra Stokes of Berlin, N. J., and was introduced to public notice by J. T. Lovett.

The list of bud varieties is a large one, and no doubt thousands of variations which might have been a basis of new and valuable strains have escaped the attention of horticulturists. But it is not alone to the marked variations or sports that the plant breeder will look for foundation stock. In fact the sudden or violent variations are always liable to reversion. Nature's method of evolution, is a very good pattern to follow in developing certain strains to meet human ideals. In the experimental evolution which the horticulturist is practicing, a definite course of action may be predicted. *First,* determine upon the ideal of the improved type desired. *Second,* cultivate and feed to encourage variation. *Third,* select through successive generations buds, that is cuttings or scions, from branches which bear fruit most nearly approaching the ideal.

Organic evolution has taken place by the selection in each generation of those differences which give the survivors a slight advantage in the struggle for existence. Horticultural evolution, or the systematic production of better types of cultivated plants by man, may take place by the selection of individuals (buds) in each generation which most nearly conform to the

* American Garden, 19, 514, 1898.

ideal type; since, as already intimated, the necessity for a struggle for existence has been obviated.

The whole practice of propagating the common fruits, as followed by most of the nurserymen of today, is radically wrong, and tends to deterioration rather than to improvement. Buds are often selected promiscuously from bearing trees, from barren trees, and from nursery stock of unknown character, and as a result a large proportion of the orchards all over the country contain trees which do not pay the interest on the land they occupy. In the horticultural world a stimulus is needed like that which the Babcock test gave to the dairy world. Some resultant weeding would follow and fruit growers would rise in their might and demand greater care in the production of trees.

It is encouraging to note that a few nurserymen are awakening to the situation and are advertising pedigree stock; but while the signs are hopeful, the intelligent orchardist of the future will be an amateur plant breeder; will set his trees of some strong, vigorous stock, and will top work with the variety or strain which is most desirable.

Some Results of Breeding.

In the foregoing notes some of the methods of plant breeding as applied to fruit, and something of the history of the development of the science in this country, have been given. The significance of the work, and some of the results accomplished in the evolution of American fruits, may properly be considered at this time.

At the beginning of the nineteenth century, almost all of the cultivated fruits were of foreign origin. At present fully 90 per cent of the cultivated apples, and nearly as large a proportion of the pears, are of American origin; that is, have originated from American seedlings. Of plums, the American seedlings of European and Japanese species, together with important native types, and hybrids of these with the foreign species, are rapidly assuming prominence. In the cultivation of grapes, raspberries, blackberries and gooseberries, little progress was made until native species were taken up and improved; and the last half century, indeed the last decade, has seen a most marked development in all of these fruits. It is interesting to note, as bearing upon the general advance in the amelioration of fruits,

that many of the now most important fruits were not only unheard of but were not thought of, as cultivated plants, within the memory of those now living. The improvement of native types has in nearly every case been the result of necessity rather than choice.

The introduction of fruits from Russia and from China and Japan, together with the accidental and systematic crosses between these and the native species and older domesticated types, has not only widely extended the range of fruit growing in this country, but has given a new impetus to the study of fruits and to the production of important forms to meet special requirements. The development of a few of these more important types may be profitably considered.

THE STRAWBERRY.

The strawberry has been under cultivation for centuries, but systematic attempts at improvement are of comparatively recent date, extending back a little more than 200 years in Europe and only about half a century in America. The earliest horticultural variety of which there is any account is the Fressant which dates from 1660. Wild species of strawberry are few in number, certainly not more than a dozen, and only a part of these wild forms have ever been brought into cultivation. Nevertheless, so wide has been the variation under cultivation that at the present time there is the anomaly of a fruit, appearing within a little more than a century, which the botanist does not refer to any species. Here then is a remarkable and practical example of experimental evolution. The history of this evolution has been fully worked out by Bailey, and a few brief notes of his investigations are given in this connection.*

The systematic improvement of the strawberry began in England. The first foreign species to reach Europe was *Fragaria virginiana,* the common field species of New England and the whole Atlantic coast. This is recorded in 1624, but does not appear to have varied greatly, and never found favor on the continent. In England, however, it was more highly esteemed, and after a lapse of 2 centuries—in 1824—Barnet writes enthusiastically "This (the old scarlet strawberry) was doubtless an

* Survival of the Unlike; also American Naturalist, 28, 293.

original introduction from North America. It is singular that a kind of so much excellence as to be scarcely surpassed by any of its class, should have been the first known. It continued in cultivation considerably more than half the period of its existence as a garden fruit without any variety having been produced of it, either by seed or by importation from America."* At this time, however, (1824), Barnet described 26 well marked varieties of the species, at least 4 of which seemed to have come directly or indirectly from America, and probably from wild plants. Thus at the opening of the nineteenth century considerable progress had been made in the amelioration of the strawberry by simple and unsystematic selection. The varieties, however, were much alike and gave little promise of the wonderful development which so soon followed.

About 1712 a second American species, *Fragaria Chiloensis,* was taken from Chili to Marseilles by a Captain Frezier. It reached England in 1727. The plant is stout, thick leaved, rather coarse, bearing large, globular, somewhat pointed, late, dark-colored fruit. The flowers are often imperfect and fail to become fertilized. The species met with but little favor and at the time Barnet wrote, a century after its introduction, so little variation had occurred that only 3 varieties which could be referred to this species were known, and one of these was considered identical with the original plant as introduced by Frezier. The plant was also grown to a very limited extent in France, but there seemed little save size of fruit in the parents of this species, and less in its record under cultivation, to commend it to the attention of the horticulturist.

Some 50 years after the introduction of the Chilian strawberry, a third type made its appearance in Europe. No one knew just how or when it came. Because of the pineapple fragrance of its fruit, it was commonly known as the Pine strawberry, and was described and figured as such by Phillip Miller in 1760.† There were many theories as to its origin but none were more probable than that of Duchesne who, in his Natural History of Strawberries in 1776 ‡ described

* Transactions London Hort. Soc., 6, 152, 1824.

† Gardener's Dictionary.

‡ Histoire Naturel de Frasiers, par M. Duchesne fils

a pineapple strawberry as *Fragaria ananassa* and argued that it must be a hybrid between the Chilian and the Virginian. Pineapple strawberries were found in France about the same time as in England, and the two, only differing from each other in a slight degree, came to be regarded as variations of the same stock, a type upon which Ehrhart, in 1792, bestowed the name *Fragaria grandiflora.*

What then is the ancestral type of cultivated strawberries? According to Barnet, whose work has been previously mentioned, there were in all 7 groups of cultivated varieties in 1824; but only 4 of these were of the large fruited types. The Pine, being comparatively a new type, included 20 distinct varieties, and among them one which marks an epoch in the annals of strawberry culture in England, namely Keen's Seedling. From Keen's Seedling, first known in London in 1821, most of the modern strawberries have descended.

At the time Keen's Seedling was produced in England, there were no important varieties of American origin and for some reason Keen's Seedling did not thrive in this country. Prince, in 1828,* mentions 30 varieties of strawberries in American gardens, all but one of which were of foreign origin, and even as late as 1837 Hovey wrote, "as yet the plants of nearly all the kinds under cultivation have been introduced from English gardens and are not suited to our climate.† At the time Mr. Hovey made this statement, however, he was at work in a systematic way at the breeding of plants which should meet existing conditions. He selected parents representing distinct ideals and the best adaptation to American conditions. In one series of crosses which he made 4 varieties were used. From these crosses two varieties, Hovey and Boston Pine were obtained.‡ Owing to the loss of some labels it is not quite certain which crosses gave these varieties, but, according to Bailey, Mr. Hovey was always confident that the Hovey was the result of Mulberry crossed by Keen's Seedling, so that the Hovey was a true pine strawberry. Hovey's Seedling was to American strawberry culture what Keen's Seedling was to English, and most

* Treatise on Horticulture, 72.

† Magazine of Horticulture, 3, 246, 1837.

‡ Magazine of Horticulture, 6, 284, 1840.

of our modern varieties have come directly or indirectly from this one source.

The American strawberries then are lineal descendants of the old Pine class, known to botanists as *Fragaria annassa* and *Fragaria grandiflora,* and this type (species?) as conclusively shown by Bailey* is a direct modification of the American species *Fragaria Chiloensis.*

The history of the production of later varieties is simply a repetition of the work started by Hovey;—a history of crossing and selection with reference to certain specified ideals or in many cases of fortuitous variation and chance discovery. It has been thought that a common perfect flowering variety might impress itself upon a pistilate sort, through its pollen, to such an extent as to effect an immediate modification of the quality or character of fruit.† But further study invariably reverses any such conclusion. Much valuable work, however, has been done, and is being done, in the systematic combining of characters of different varieties by crossing and in the "selection of the most coveted." Attempts to modify the habit of strawberry plants by change of environment have not been particularly successful; though some forms, like the Parker Earle, show a strong tendency to curtail the runners, and varieties strongly resistant to fungus attack are numerous.

GRAPE

The grape has for many years been the object of systematic work by American horticulturists. It is worthy of note, however, that many of the varieties most highly prized at the present day,—including Catawba, Isabella, Vergennes, Herbemont, Norton's Virginia and others—are simply chance seedlings, discovered in the wild, and domesticated by some careful observer. Some of the varieties named have given many seedlings of merit, besides the definitely recorded crosses made in more recent years. Catawba, for instance, has given Diana, Iona and many others; while Concord, which was a chance seedling discovered by Ephriam W. Bull and first sent forth in 1853, is the parent of a large family of valuable sorts including

* Am. Nat., 28, 301.

† Proceedings of the American Pomological Society, 1885, p. 66.

Eaton, Martha, Moore's Early, Pocklington, Worden, and others.

A marked step in the improvement of the grape was made in 1850 when John Fiske Allen of Salem, Mass., crossed the foreign Golden Chaselas with Isabella. The first of these American hybrid grapes, known as Allen's Hybrid, was exhibited before the Massachusetts Horticultural Society September 9, 1854. Though of excellent quality, this grape was so tender and subject to rot that it was never widely planted. It is of importance, however, as one of the parents, with Concord, of that delicious white grape Lady Washington; but its chief significance was the fact that it was the beginning of a new era in the improvement of grapes, namely, the production of seedlings of known parentage by means of systematic crossing.

With a few exceptions, all of the American table grapes are the result of careful selection and breeding since 1850; and a record of the productions since that date is a record of the work of Rogers, Ricketts, Caywood, Jacob Moore, Munson, Campbell and other equally enthusiastic amateurs or practical nurserymen.

There is little difficulty in producing seedling grapes of the finest quality by crossing the best native species with varieties of *Vitis vinifera.* Unfortunately, however, hardiness of vine and vigor of constitution are usually sacrificed. Occasionally a seedling is produced which combines the excellence of the two parents, and here is the first step in improvement. It was along this line that E. S. Rogers of Roxbury, Mass., following the lead of Allen, worked; and many of his hybrids have justly won a place in popular favor. Among these may be named Salem, Agawam, Wilder, Massasoit, Goethe. The greatest weakness of these varieties results from their imperfect blossoms and consequent irregular bunches of fruit. Rogers believed that the line of improvement lay in crossing his hybrid with the foreign species; but, though thus producing fruit of exquisite flavor, the increased tenderness and weakness of the vines rendered these second crosses nearly worthless.

J. H. Ricketts, a bookbinder of Newburg, N. Y., for more than 20 years continued his careful work in the production of crosses and hybrids. His early work, like that of Rogers, was mainly in the effort to produce hybrids with the European grape. Later, however, he undertook the production of derivi-

tive hybrids and crosses among our native species. Some of the results of his work are Empire State, Lady Washington, Eldorado and Jefferson.

Jacob Rommel of Morrison, Mo., holds the place as a leader in the production of wine grapes adapted to the conditions of the Southwest. Among his products may be mentioned Elvira, Amber, Black Delaware and Pearl—all products of crosses with native species, mostly *Vitis riparia* and *Vitis labrusca.*

Jacob Moore of Brighton, N. Y., was the originator of several valuable grapes as well as other fruits. It is enough to mention Brighton and Diamond. The first a cross of Concord and Diana-Hamburg; the other also a secondary cross between Concord and European (Vinifera) stock. (Diamond is a cross between Concord and Iona.)

George W. Campbell of Delaware, Ohio, after spending many years working at random, settled on the definite work of improving existing types along certain well defined lines. For example a Catawba without the tough acrid pulp about the seeds; a Delaware of larger size and more vigorous habit, or a Concord of fine flavor and better shipping qualities. His greatest success was in his last mentioned effort, the result being Triumph and Campbell's Early, which are really improved Concord.

Dr. A. T. Wylie of North Carolina should be mentioned because of his attempts to bring into service the native Scuppernong grape in producing hybrids for growing in the far South.

The list of those who have contributed to the number of varieties of grapes suitable for different conditions and localities, varieties of intrinsic merit, is a long one, and it is unnecessary to speak in detail of the work of Caywood, of Barry, of Arnold, of Grant, and some others; but the man who has done the most extensive work in improving the native species of grapes, and extending the list of varieties suitable for the Southern States, is without question Mr. T. V. Munson of Dennison, Texas. The value of his work is not confined to the South alone, however, as those who are familiar with Brilliant and others of his newer varieties are aware. Among the best of the Munson productions are America, Beacon, Captain, Carman, Brilliant, Gold Coin, R. W. Munson. During the past 25

years, Mr. Munson has produced 75,000 seedling varieties, including hybrids between the Post-Oak grape of the South and several other native species, as well as combinations of well known varieties and species.

THE PEAR

The European pear is of particularly fine quality and in recent years has been found to succeed well on the Pacific Coast, but it has never proved wholly satisfactory in the Eastern States and is a total failure in the South. As will be remembered, Flemish Beauty and several of our choicest European varieties are found especially subject to disease, and in the earlier years of American pomological history the failure of the varieties which were general favorites in France and Belgium was attributed to deterioration of the variety itself,—in other words to "running out." William Kenrick wrote of these pears:* "Except in certain sections of the city, and some few solitary and highly favored situations in the country round, they have become either so uncertain in their bearing—so barren—so mortally diseased—that they are no longer to be trusted; they are no longer what they were once with us, and what many of them are still described to be by most foreign writers."

One of the first varieties of native introduction was the Seckel, and to this day it remains the standard of excellence among pears. The origin of this variety is not quite certain, though it is supposed to have been a chance seedling. It first attracted attention in the garden of Mr. Seckel of Philadelphia, who is generally regarded as the originator; but Thomas Andrew Knight believed it to have originated in a Swedish settlement near the city about the middle of the eighteenth century, Mr. Seckel having obtained cions of it from Jacob Weiss, who obtained the original tree from the Swedes.†

Some other well known varieties originated as chance seedlings in the early part of the last century. Among these may be mentioned Tyson, Andrews, Fulton and some others. As the superior value of American seedlings became recognized, the practice of planting the seeds of the best fruits became common. One of the most extensive producers of these seedling varieties

* New American Orchardist (2nd ed.), 25.

† Cf. Trans. Lond. Hort. Soc'y, 3:256, 1819.

was Mr. Dana of Massachusetts, the originator of Dana's Hovey. This sort appeared about 1860, and was the best of his seedlings, of which he had some 5 or 6 thousand.

Among the best known varieties originating in Maine may be mentioned Eastern Belle and Indian Queen, seedlings raised by Henry McLaughlin, Bangor; McLaughlin, sent out by S. L. Goodale of Saco; Goodale, a seedling of McLaughlin; and Fulton, a chance seedling from Topsham.

The development of the cultivated pear owes little to the hand of man in producing hybrids; yet, with the possible exception of Bartlett, the few hybrid varieties produced—notably Kieffer, Le Conte, and Garber—are by far the most important commercial sorts, and have made possible the cultivation of the pear over the greater part of our country. These varieties, as now generally recognized, are accidental hybrids between the European pear and the Chinese sand pear. The latter is a vigorous, healthy tree, of no value save for ornament or as stocks for other sorts, but is native to a region not unlike our own eastern and southern states. The hybrids combine to a large degree the good qualities of both parents, and point the way to new fields of investigation for the plant breeder.

THE APPLE.

As in the case of pears, the Newtown Pippin apple, which is usually regarded as a standard of excellence, originated as a chance seedling, nearly 200 years ago. Because of its better adaptation to the climate, the apple was much more widely grown than the pear, and the production of new varieties from seed was very common. Until very recently, however, the varieties were usually the result of chance. The Baldwin, which was found in Eastern Massachusetts, in 1742, took its name from Col. Baldwin, who first brought it into general notice. The Northern Spy, originating near Rochester, N. Y., about 1800, the Roxbury Russett, the Jonathan, and, in short, most of the older commercial varieties, came about in this way.

Systematic breeding of the apple in this country is yet in its early infancy, though as long ago as the time of Knight and Van Mons crossing and selection were practiced. With the westward march of civilization the necessity of producing

hardier varieties became evident. The struggles and failures and disappointments of Peter M. Gideon in the effort to produce a variety which should withstand the trying climate of Minnesota were finally, after many years and the loss of thousands of seedlings, rewarded by the production of the Wealthy. With the introduction of this variety began a new era in the fruit culture of the northwest—indeed, this was the starting point of successful fruit growing in that region. The introductions of Russian varieties by the Department of Agriculture and by Budd and Gibb, followed by the crosses of these sorts with the hardier commercial varieties and with the native crabs, are recent history. The work of Budd, Harris, Patten, Somerville, Watrous and others in this direction has resulted in a large number of so-called ironclad varieties of very fair quality, many of which will keep until late in the spring. But this work is only begun. A discussion of the varieties originating in Maine will form the subject of an early bulletin from this Station.

THE PLUM.

The production and propagation of named varieties of native plums dates from 1814, when the seed which produced what is now known as the Miner plum was planted by William Dodd, an officer under General Jackson.* The Wild Goose was introduced in 1850, and Robinson in 1884. The latter is of special importance as one of the parents of some of Burbank's recent novelties. Since 1860 the number of valuable seedlings of the native species in the West and South is almost phenomenal. Wayland, Moreman, Golden Beauty, Newman, and others in the Southwest; Wolf, De Soto, Rollingstone, Forest Garden, Weaver, and the like in the Northwest, to the number of a hundred or more, are already grown to an important commercial extent, and it is possible that these will form the foundation of the future orchard plums of the Prairie States.

Only recently has any attempt at improvement by artificial crossing been made; and this attempt has been mainly at combining the native species with the newly introduced Japanese sorts. The work began less than 20 years ago, yet, on the authority of Professor Waugh, there are at the present time

* Cf. Bailey, Evolution of our Native Fruits, 175.

more than 30 of these hybrids which have been found valuable and named. Luther Burbank of Santa Rosa, California, is the name which is indelibly associated with the idea of Japanese plum hybrids, and to him we are indebted for Climax, Chalco, Wickson, Golden, American, and many others.

THE BLACKBERRY.

Brief reference should be made to the blackberry as a purely American plant. Though wild plants had been brought to the garden previously, the culture of the blackberry as a garden fruit dates from the introduction of the Dorchester, a chance seedling found in Dorchester, Mass., and brought to attention by Mr. Lovett in 1850. A few crosses have been introduced, but none as yet have become well known. A noteworthy hybrid of the blackberry with the raspberry should, however, receive passing notice. This is the Princess (Western dewberry crossed by Siberian raspberry) produced by Mr. Burbank. The hybrid, according to the originator, ripens its fruit several weeks before either of its parents and excels them much in productiveness and size of fruit, though retaining the general appearance and combined flavors of both. Among other raspberry-blackberry hybrids made by Burbank is Humboldt, by crossing an improved California wild dewberry with Cuthbert raspberry. As giving an idea of the uncertainty of work of this kind, it is worthy of note that the last named hybrid was the only one out of 40,000 seedlings that was deemed of sufficient value for propagation.

Some Unsolved Problems.

Each year marks a great advance in the work done in plant breeding. The work carried on by the United States Department of Agriculture, under the immediate direction of Dr. Webber, is of inestimable value; and the "new creations" in fruits and flowers which periodically appear in the garden of Luther Burbank at Santa Rosa, California, have attracted world wide attention. But the mere production of new forms of intrinsic value is not the only work in hand. It is now coming to be recognized that many diseases of plants are due to some, often times it may be slight, lack of adaptation to conditions and surroundings. The plants are "out of tune" with their environment, and this lack of adaptation, though slight, may

make the difference between profit and loss in the returns from a given crop. The disease known as *coulourc*, or the falling of the flowers and young fruit of certain of the finest raisin grapes in California is a case in point. An investigation by officers of the Department of Agriculture has shown that this trouble is mainly due to unfavorable climatic conditions at the time of blooming. If, now, the time of blooming should be delayed somewhat until the season of settled weather, or if the varieties should be rendered slightly hardier, so as to resist the unfavorable conditions, a service of untold benefit would be rendered to the raisin industry of California. In the attempt to meet the emergency, some 20 thousand crosses have been made between the two best raisin grapes—Muscat of Alexandria and Muscatel Gordon Blanco—with the Malaga, a vigorous, hardy, thrifty sort which, though an excellent raisin grape, is inferior to the sorts named.* As the seedlings resulting from these crosses come into fruitage the hardiest and most resistant types will be selected in the hope of securing the desired end.

A similar problem confronts the growers of citrus fruits in Florida and Louisiana,—a fact again emphasized by the recent severe losses from freezing. Here, again the Department of Agriculture is doing an important work in crossing the more valuable varieties of the orange with the *Citrus trifoliata*, which is hardy as far north as Philadelphia. Several hundred hybrids have been produced and are now growing; many of them showing varieties intermediate in character. Of course the end in view is to secure, by a sufficient number of crosses, a variety which shall combine the good qualities of the common orange with the hardiness of the trifoliate parent. The same method may be looked to in the production of hardier varieties of other subtropical fruits.

Another problem in citrus culture is the production of an orange with the skin of a tangerine. Hybrid seedlings to the number of a thousand or more have been produced, and results are awaited with interest. The breeding of pine-apples of superior quality, and resistant to disease, is also receiving special attention in the subtropical laboratory of the Bureau of Plant Industry, the crosses of this fruit running up into the thousands.

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* Yearbook, U. S. Dept. of Agriculture, 1898, 265.

In pear growing it is very important to combine the disease resisting qualities of the Oriental varieties with the highest quality of fruit of the European sorts. Some hundreds of crosses have been made with this in view.

In plum culture, especially in northern New England, the same problem is met. In former years plum growing was an extensive industry in the Penobscot valley, but the dreaded black knot drove the industry out of the country. Is it possible, by crossing with the Japanese varieties, which seem less subject to the attack of this disease, to produce sorts which, while resistant to disease, shall be hardy enough to resist the severe winter?

Cherries also, in years past, have formed an important item in the income of fruit growers along the Kennebec. But the demand for sour cherries in the Boston markets is limited, and the hearts and biggarreaus are very uncertain in point of hardiness. Most of the cherries for which Hallowell and Gardiner have been locally noted in the past, were seedlings of Black Tartarian. But these seedlings are very uncertain and are frequently killed back by severe winters. With a view to combining the vigor and hardiness of the sour cherries with the good qualities of the fruit of the sweet sorts, Card of Rhode Island, has made numerous crosses. A large proportion of the sour cherries crossed by the sweet varieties matured fruit which apparently was normal. Curiously enough, however, the reciprocal crosses in every instance failed to mature fruit;* and in a personal letter to the writer, Professor Card writes that in only two instances was he able to secure germination from the crosses made—and these seedlings met with an accident and were lost.

Apples, quinces, peaches and the various small fruits, are all, without doubt, capable of producing disease resisting forms which shall do away, in a measure at least, with the expense and labor of spraying and otherwise combating the numerous fungous pests with which the orchardist must contend.

While the reigning types of native fruits are the result, largely, of the force of circumstances rather than the direct choice of man, an intelligent choice of species and of forms has, nevertheless, played an important part in the evolution of these types, and it may play a still more important part in the years to come.

* Rpt. R. I. Expt. Station, 1899, 130.

As suggested at the beginning of this discussion, plant breeding in its relation to pomology has as yet been largely fortuitous. Little study of fundamental laws has been made. Thousands of crosses have been made and hundreds of thousands of seedlings have been produced, but the work has been largely without definite ideals in view, and without a view of probable means of reaching an ideal. In the judgment of the writer, the problems of propagation, environment, and individual variation are of quite as much importance, and are certainly as little understood, as are the obscure problems of cytological variations and combinations.

Many years ago Thomas Andrew Knight popularized the method of root grafting, and the question of the mutual influence of cion and stock has long been a fertile one for discussion. Nevertheless little accurate work has been done in studying the problems thus involved.

It is known, in a general way, that certain chemicals have specific effects upon the color, composition or other characteristics of fruits, but accurate data in this direction are scarce. The fact of individuality in fruit plans is recognized, but its importance as a factor in the development of a type has been almost wholly overlooked.

The fact of the existence of graft hybrids is freely maintained, but the principles involved in the production of such forms remain a closed book.

In the past most discussions of pomological problems have been empirical. There are certain principles underlying the subject, however, which, in common with the improvement of plants in general, are fundamental and far reaching in their importance. It is to this class of problems, more scientific but not less practical in their nature, that pomologists and plant breeders alike are devoting thought and study at the present time. The solution of some of these problems, and the classification of knowledge concerning the subject, is necessary in order to raise pomology to the rank of a distinct science.

FIG. 16. Apple trees stripped by brown-tail moth. Winchester, Mass , June 9, 1905. Photograph loaned by A. H. Kirkland.

INSECT NOTES FOR 1906.

Edith M. Patch.

Brown-tail Moth and Gypsy Moth.

Since 1903 the brown-tail moth has become established throughout the Southern and most of the coast counties of Maine. In December, 1906, egg clusters of the gypsy moth were found in Kittery and Eliot. The caterpillars of the brown-tail moth are capable of ruining orchard, shade, and many woodland trees. They are also a dreaded nuisance because their hairs breaks off and on coming in contact with the human skin, cause extreme irritation and often illness. The caterpillars of the gypsy moth attack nearly every kind of vegetation and their work is especially fatal to pine and other evergreens since these trees always die after being once defoliated.

Brown-tail Moth.

So serious a pest should be known by every one in the State, because although extermination of this insect may not be possible, much practical and effectual work can be done in holding it in check and reducing its numbers to such an extent that damage to orchard and shade trees may be very slight.

For the past two years the State Department of Agriculture, the State Pomological Society, the Maine Agricultural Experiment Station, the town and city officials, and the citizens of the infested localities have worked in unison against the brown-tail moth. As a result this insect has not yet done very serious damage in this State, and the cases of poisoning have been very few. This is cause both for congratulation and encouragement for it shows that even if the brown-tail moth cannot be exterminated, its ravages may be in a large measure controlled. But the same distressing conditions threaten the State this coming year, and over a much larger district, and to be met successfully these conditions must be met as vigorously and as earnestly as they have been previously.

A simple warning to any one who may not be alive to the importance of fighting this insect is given in this bulletin by the significant photograph kindly supplied by Mr. A. H. Kirkland, State Superintendent for Suppressing the Gypsy and Brown-tail Moths in Massachusetts. The photograph, Fig. 16, shows apple trees stripped by caterpillars of the brown-tail moth, June 9, 1905, Winchester, Mass.

DESCRIPTION AND HABITS.

The moths. The moths, expanding from one and one-fourth to one and three-fourth inches, are white except for the abdomen, which is tinged with brown and tipped with a tuft of brown hairs. This tuft is small and dark in the male, but the large golden-brown tuft in the female is conspicuous enough to be the most striking characteristic of the moth, and has won for this insect its descriptive name of "brown-tail." These moths are on the wing in July, and unlike some closely related pests, the brown-tail females as well as the males are strong fliers. They are active at night, and as lights have an attraction for them, they sometimes fly a long way toward a lighted district.

The eggs. The female usually selects a leaf near the tip of the branch on which to deposit from 150 to 300 eggs. Some of the brown hairs from the abdominal tuft adhere to the egg-mass and give it the appearance of a brown felt lump.

The caterpillars in the fall. By the middle of August most of the eggs are hatched and the young caterpillars spin a slight web over the leaf near the egg cluster. From this protection they advance side by side, sometimes 200 tiny caterpillars feeding in an unbroken line, though they huddle together beneath the web when disturbed in any way. When they have eaten all but the skeleton of the first leaf, they draw another into the web and repeat the process at intervals during the late summer. They feed slowly, however, and spend so much time spinning their web that they do comparatively little damage to the trees in the fall, and they are still very small, (about one-fourth of an inch in length,) when cold weather comes on.

The Winter Nests. In the fall the young caterpillars weave additional layers of silk about their retreat, fastening it securely to the branch by the web, and pass the winter thus in colonies of 150 to 300. This is a very unusual yet most commendable habit in a caterpillar pest, for they can be killed, hundreds at a

FIG. 17. Winter nest of brown-tail moth with one attachment to twig.

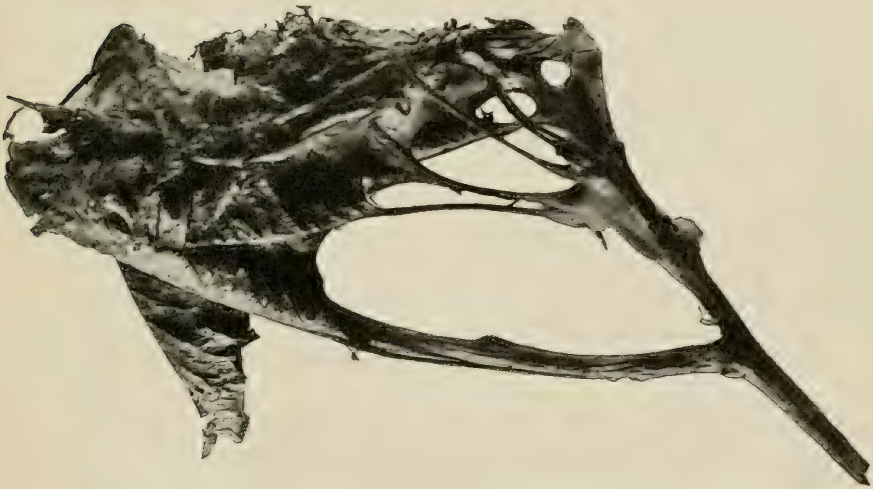

FIG. 18. Winter nest of brown-tail moth with several attachments to twig.

time, simply by burning the nests in which the colonies hibernate. The nests, composed of leaves bound firmly together by silken web, are varied in shape, those upon oak trees for instance being differently formed from those upon wild cherry, in accordance with the difference in the size and pliability of the leaves. They vary too, more or less, upon the same tree, in the number of attachments to the twig and somewhat in size. However, this variety in size and shape serves as a distinctive mark, as it distinguishes nests of the brown-tail moth from the uniform and regular shaped cocoons of other moths found often upon orchard trees in winter. In spite of the superficial variety, the essential characteristics of the brown-tail moth nests are soon learned, and even anyone unfamiliar with the nest can make himself perfectly certain if he will cut carefully into the nest. *If the structure contains one or more silken cells filled with tiny living caterpillars it is the winter nest of the brown-tail moth.* Two types of the winter nests are shown in Figs. 17 and 18.

The caterpillars in the spring. Early in the spring the young caterpillars emerge from their winter nests and feed upon the opening leaf buds. Until about the middle of June they feed greedily upon the leaves, completely stripping the trees where they are numerous. Orchard trees are especially susceptible, but oak, elm, and many other shade and forest trees are often ruinously attacked. When full grown the caterpillars are about one and one-half inches long. They are dark brown with a sprinkling of orange. Long, fine reddish-brown hairs cover the body, and a row of conspicuous white hairs runs along each side. Like the caterpillars of the tussock and gypsy moths, they bear bright red tubercles on the top of the sixth and seventh abdominal segments.

Poisonous qualities of the caterpillars. Were the caterpillars to be feared only for their ravages upon orchard and other trees, the situation would be alarming enough, but not less serious is the physical discomfort experienced by people living in infested districts. When the minutely barbed hairs of the caterpillar come in contact with the skin they cause an eruption similar to and in many cases worse than ivy poisoning. These hairs are brittle and where the caterpillars are numerous few people are likely to escape, as the caterpillars drop from the branches and creep about, even entering houses. Direct contact with the insects themselves is not necessary however, for when the cater-

pillars shed their skins the molts are blown about, widely scattering the barbed hairs. Thus in infested districts it is no uncommon occurrence for whole families to suffer from the rash caused by the hairs which settle upon clothes hung out to dry. Children gathering cherries are badly "poisoned," and people have been obliged to leave their homes for uninfested places in order to recover from attacks of the "caterpillar rash," which sometimes results in serious illness.

The cocoon. The caterpillars are usually full grown in June. They then spin loose cocoons, attached commonly to leaves, though sometimes other shelter is sought. Within these they transform to brown pupæ about three-fourths of an inch long. From the first to the twentieth of July the moths with pure white wings and brown-tipped abdomens emerge from these cocoons to deposit eggs for the next generation of caterpillars.

REMEDIAL MEASURES

Natural Enemies. In the course of time, the natural enemies may become established also and take their share in the work. Doctor Howard, Chief of the Bureau of Entomology, and Mr. A. H. Kirkland, Massachusetts Superintendent for Suppressing the Gypsy and Brown-tail moths are uniting their efforts in introducing parasites of these moths from European countries. Results from such work are necessarily slow and though the parasites may in time become a most effective means of lessening the numbers of these introduced pests, as parasites already do with many native moths, for the present season at least they cannot be expected to serve for a substitute for other remedial measures.

Cutting and burning the winter nests is the most important of the remedies because it is the easiest, cheapest, and, if thoroughly done, a sufficient protection against the ravages of this pest. The webs and leaves that compose the nest are woven tightly to the tips of the branches and hang there like dead leaves all winter. With so many months for inspection there is no excuse for harboring the hibernating caterpillars on shade or orchard trees. After they are cut from the branches, the nests should be burned, as this is the simplest way of destroying the colony within.

Destruction of breeding places. Much can be done in infested districts by clearing out wild cherry tangles and other growths which serve as a breeding place for these moths.

Spraying. The caterpillars are readily killed by arsenical sprays. The remedy is most effective when applied as soon as the leaves develop in the spring. Of course where the winter nests have been destroyed there will be no need of this remedy and it is much easier to kill about 200 caterpillars enclosed in a nest than to wait until they are scattered over the tree.

Legislation Against the Brown-tail and Gypsy Moths

Legislation in Maine. In Maine the alarming invasion of the brown-tail moth during 1903 and 1904 emphasized the need of legislation against the ravages of dangerous insects and diseases, and in February, 1905, an act was passed to provide for the inspection of nurseries and incoming nursery stock, and placed with the Commissioner of Agriculture the duty of investigating any locality where the presence of dangerous insects or plant diseases may be suspected.

National Legislation. Appreciating the necessity of combating the brown-tail and gypsy moths which threaten not alone the New England States, but the vegetation of the whole country, the last United States Congress passed an emergency appropriation of $82,500 to be used in preventing the further spread of these insects as far as possible.

Aroostook Potato Insects.

Wherever native vegetation is destroyed over a large area and a cultivated crop substituted, the equilibrium of insect conditions is upset, and a readjustment ensues. If the plant-feeding insects of the locality are able to adapt themselves to a diet of the cultivated crop, the readjustment is of economic interest.

The potato fields of Northern Maine present an opportunity for observation along this line. Approximately 6,000 acres have been opened to the potato crop in Aroostook County during the past 16 years. What has become of the insects originally feeding upon other vegetation over these 6,000 acres is chiefly a matter of fruitless speculation. In general they have died, changed their location, or accepted the potato as an article of diet.

The inevitable Colorado potato beetle is taken philosophically here as elsewhere as a part of potato culture, and certain

fields kept clear of it by adequate spraying and, especially late in the season, certain fields given over to its ravages with apparent indifference.

Tomato Flea Beetle. Probably more serious injury to the potato vines is inflicted by the common tomato flea beetle, *Epitrix cucumeris,* than is generally credited to this insect by potato raisers, as it is found upon the leaves during the whole season, often in enormous numbers, and the punctured and riddled leaves cannot of course do full duty in such a condition.

Smartweed Flea Beetle. In addition to these two foregoing omnipresent pests, the Aroostook fields possess some more distinctive features. About the middle of September the smartweed flea beetles, *Systena hudsonias* were even more numerous than the smaller species. Both at Caribou and Houlton they were especially abundant and a potato leaf untouched by them could scarcely be found.

Cosmopepla carnifex. A pretty black and red bug, *Cosmopepla carnifex,* content before the advent of the potato to feed upon tender poplar shoots, and mint and buttercup stems, has shown no hesitation in accepting the new feeding grounds. By way of illustration it may be cited that on Sept. 12 at Caribou 11 of these bugs were found with their beaks deep in a single potato stalk. The bugs looked healthier than the stalk.

Pentatoma juniperina Linne. This large green bug, not uncommon in the State upon evening primrose, was found upon the potato, at Caribou July 11, where it was accused of wilting the stalk.

Tarnished Plant-Bug. The tarnished plant-bug, *Lygus pratensis,* of evil reputation everywhere, is guilty of various annoyances in Maine. In some parts of the State, pear trees suffer through serious attack of the swelling leaf and flower buds in the spring. In a second the aster buds are "buttoned" by this bug so that "no perfect flowers can be obtained for sale." From a third, complaints accompanied by tarnished plant-bugs, state that all of many dahlia blossoms are deformed,—opening feebly only on one side. At Portland they were thick upon celery. The adults of this species can be startled from goldenrod blossoms almost anywhere in the State. It is not surprising to find such an adaptable insect taking without question the food offered it over thousands of acres of potato vines. About the middle of September different fields over a stretch of 7 miles

near Houlton were visited. All these fields were infested by the tarnished plant-bugs, and in one field visited early in the morning before the insects had warmed up enough to be much on the wing 40 or 50 plant-bugs to a single plant was not an unusual number. This fact seems an alarming one, for though the injury so late in the season may not be of great importance, the hibernating adults, if they attack the early tender shoots in the spring as is their habit on other plants, will cause much deformed and stunted growth another season. The tarnished plant-bug is not an easy foe to meet. Paris Green or other stomach poisons are useless against an insect with sucking mouth parts. Kerosene emulsion or other contact remedies are not practical for a pest which is so easily startled to flight. At the slightest disturbance the plant-bug is on the wing and in condition to return to the plants when the danger is over. From certain garden plants the plant-bug can readily be shaken onto a cloth or into a pan containing kerosene, early in the morning or on cold days when they are too sluggish to be easily alarmed. Such a means would, of course, be impractical in a potato field. There remains apparently but one vulnerable point, based upon the fact that the tarnished plant-bug hibernates in the adult condition among weeds or other rubbish. The custom of potato raisers of raking up and burning the old vines in the fall in order to have fields clear for fall plowing is therefore one of the most effectual ways of destroying the shelter of these bugs. If, in addition to clearing away the old vines, the weeds and rubbish along the edges of the potato fields should be burned on a cold day, great numbers of the tarnished plant-bugs would be destroyed with comparatively little cost and time. If the plant-bug continues to appear upon the potato vines, this means of combating it should be resorted to regularly each fall.

Nectarophora solanifolii. In a land flowing with honey dew as has been the whole State of Maine for several years past, even the potato cannot hope to escape aphid attacks. A large green species, *Nectarophora solanifolii* Ashm. has for 3 seasons attacked the potato vines in the vicinity of Houlton and elsewhere to an injurious extent. The colonies cluster thick on stem and leaf, thousands to a plant, frequently wilting the stems and drying the leaves. The worst of the attack comes between the middle of August and the middle of September in time to weaken the plant and thus affect the growth of the tubers. The

true sexes of this species do not appear upon the potato. It is not yet known what plant serves for the alternate host.

Aphis sp. This present season in some parts of Aroostook, conspicuously at Caribou and vicinity, a second species of plant louse, an undetermined and probably a new species belonging to the genus *Aphis,* has heavily infested certain fields. They were beginning to appear upon the vines about the middle of July and they had not all taken flight by the middle of September. At the later date colonies of pupæ could be found here and there at Caribou, clustered thick enough on stalk tip and new growth to hide the stalk. The bodies of these pupæ shaded from pink to salmon and from green to brown. They seem invariably to feed head down.

The presence of plant lice to such an extent upon potato vines raises several perplexing problems. If a fairly uniform attack could be reckoned on each year, the cost, benefit and practibility of emulsion sprays on the infested fields would be well worth testing. Plant louse atatcks, however, are likely to be erratic, influenced by climatic conditions and by decrease and increase of parasites and predaceous insects. As yet it seems to be an open question as to whether it is most practical to attempt to combat the aphids in the potato field by artificial means, or leave them to fluctuate according to natural influences. At any rate their presence is to be regretted. Even a light attack which would not perceptibly weaken the plant, probably renders it more susceptible to fungus diseases than it would normally be. For the past 3 years the aphid attacks on potato have been widespread. Dr. James Fletcher, Central Experimental Farms, Canada, writes from Ottawa, September, 1906. "The aphis has been extremely abundant on our potatoes all through this part of Canada this year." It also troubled Canadian fields in 1904.

Alder Blight and Attendant Insects.

A conspicuous illustration of the natural fluctuations of insect conditions is given by *Pemphigus tesselata* in the vicinity of Orono. This species, a large dark bodied plant louse infesting the trunks and branches of alder (*Alnus incana*), is often mistaken for fungus on account of the snow-white flocculent matter with which it is covered. For several seasons the alder clumps here as in many other parts of the State have been white stemmed with this woolly plant louse, and early in September the air has been alive with the winged forms.

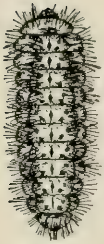

FIG. 19. The Harvester.
Larva x 2.

FIG. 20. The Harvester.
Chrysalis x 2.

FIG. 21. The Harvester, *Feniseca tarquinius*.
Adult x 2.

Syrphus maggots. The chief enemy which had for two seasons confronted the "alder blight" was a syrphus fly, which could be seen hovering near the colonies for the purpose of depositing eggs. The maggots hatched from these eggs fed greedily upon the large soft bodied plant lice, but the enormous numbers of the plant lice did not seem to be materially lessened. The winged forms were plentiful last fall, 1905. This spring the colonies were common but not so numerous as for several seasons past. The syrphus maggots work industriously and often white "wool" upon the alder stems was found to cover more maggots than plant lice. It seems likely that the syrphus flies could clear the vicinity of "alder blight." Late in the summer, however, it was discovered that the syrphus flies no longer had the "alder blight" to themselves. A rival appeared in the form of the Harvester butterfly.

The Harvester, Feniseca tarquinius. (Fig. 19). During September caterpillars of the Harvester could be taken in almost any colony of "alder blight" in the neighborhood. Like the syrphus maggots, these caterpillars burrow beneath the woolly secretions of the plant lice and are covered from sight. The full grown caterpillar is slightly more than one-half inch in length and slug like in shape. The body is drab colored and the head a shiny brown. The 12 segments of the body are deeply creased and scalloped along the lateral margin. There is a mid-dorsal line of black dots with an orange spot at each side. Each orange spot is lined laterally with black. The body is well covered with black bristly spines to which flocculent masses from the alder blight becomes attached. The curious chrysais (Fig. 20) of this insect is a half uncanny, wholly fascinating little object with the dorsal aspect possessing a remarkable resemblance to a monkey's face. The adult butterfly (Fig. 21) expands about one and one-fourth inches. The colors of the upper surface of the wings are black and tawny. The black spots are subject to much variation in form and size.

So industriously did the Syrphus maggots and the Harvester caterpillars feed upon "alder blight" that by the end of September hardly a colony of this plant louse could be found in the vicinity of Orono.

Alder blight covered by ants. In connection with a series of observations which were being made this season on alder blight, an interesting bit of ant work was noticed August 30. A colony

of ants had its quarters in some small decaying tree trunks fallen at the base of a clump of alder. Two of the alder stems were thickly infested with *Pemphigus tesselata* much visited by ants for the honey dew. In this case the ants had built a covered tunnel from the base of the alder stems to the distance of nearly 2 feet on one stem and more than one foot on another. This structure was composed of sawdust-like particles and enclosed small clusters of the aphids which seemed undisturbed by the proceedings. The stems were upright and one ant tunnel was erected vertically along the stem while the second was more or less winding. The ants varied their occupation of extending the tunnel with sipping upon the convenient honey dew. Specimens of these ants were identified by Mr. Theo. Pergande of the U. S. Department of Agriculture as *Lasius mixtus* Mayr.

LARCH CASE-BEARER, *Coleophora laricella* Hbn.

Throughout Washington, Hancock, and Penobscot counties at least, and probably over a larger area a very minute moth has been to work on the larch, (*Larix americana*), or hackmatack, or tamarack as it is variously called.* The insect winters in the larval stage upon the larch and attacks the tender needles when they first start in the spring. Although minute they have been present in such enormous numbers that larch trees have often been, during the past 3 seasons, eaten bare of green early in the spring. The caterpillars feed by eating a hole in the side of the needle and then devouring as much of the inner portion as it can reach. It thus has the characteristic manner of feeding common to related leaf miners. The injured needles often continue to grow but the clusters are ragged and many of the needles brown and dry. Small larches in the vicinity of Bangor and Orono which have been subjected to an attack of at least 3 seasons died this summer from no other apparent cause than the presence of great numbers of the case-bearers which kept the needles eaten off. Many large larches infested by this insect look yellowish and unhealthy.

The larva. The caterpillar is a case-bearer, that is, it protects its body with an external covering or case. The larch

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* Although so well supplied with popular names of its own, this tree is also erroneously but very commonly called the juniper in Maine.

case-bearer uses a bit of dried spill from the larch for its case and from this protection it extends its head and thoracic feet when it wishes to move about or feed. Along the ventral side the spill is split and pieced together with silk woven by the tiny caterpillar. As it grows it weaves an extension of this silk on the anterior part of the case. The full grown caterpillar is about 3 millimeters* in length. The case measures 4 millimeters or 5 millimeters. The caterpillars are much more active during warm and sunny weather, and during cold days they do no feeding. When fall comes on the nearly grown caterpillars in their little spill cases attach themselves to the bark and about the bud angles and live dormant for the winter. With the first warm days of spring the caterpillars become active and feed upon the soft tender larch needles. As the caterpillars are nearly full grown this is their most vigorous feeding spell and as the larch needles are eaten when they first begin to grow, it is a particularly hard season of the year for the tree to endure such an attack. The same number of case-bearers later in the season would by no means create so much damage.

The full grown caterpillars do not leave their cases but attach them to the twig or commonly in the cluster of needle-shaped leaves where they are not easy to find and let the cases serve for a cocoon.

The moth. In the vicinity of Orono the adult insect emerges about June 4. They are a glistening ash gray in color. The wings are slender and the hind wings have the deep delicate fringe common to this group of moths. It expands about 9 millimeters. This moth is something the shape of the common clothes moth and a little smaller. The female deposits the eggs in among the larch needles and the young naked caterpillar eats its way into a needle and after disposing of the soft interior as food, uses the empty shell for its case.

There is fortunately but one generation a year. Observations upon these case-bearers about Orono had been made during 2 seasons when Dr. James Fletcher, Central Experimental Farm, Ottawa, published his interesting account of the appearance of the Larch case-bearer, *Coleophora laricella,* in Canada (Report 1905). Doctor Fletcher kindly compared specimens bred in Maine with the Canadian *Coleophora* and pronounced them undoubtedly the same species. Ratzeburg in his Forst-

* One inch nearly equals 25 millimeters.

Insecten gives excellent figures in color of the larva, moth, and work of *Tinea laricinella,* which if it is not the same species as *Coleophora laricella* so closely resembles it that the same figure would serve for both.

There would not seem to be any practical remedy against this insect in large growths. Since it eats the inner portion of the needles and leaves the epidermis, arsenical sprays would hardly avail on the larches used for ornament. In nurseries, badly infested trees should be burned. From very small trees the majority of the cases could be removed by hand during the winter. Japanese Larches* are said to be immune from attack by this case-bearer.

Miscellaneous Notes.

Of the many insects which naturally come under observation during the season, a few are conspicuous for various reasons, as the attendance of particular parasites, the occurrence in great numbers of an insect not usually abundant, or the appearance of an insect on some plant it does not usually attack. Such instances are often of more than passing interest and are conveniently recorded under miscellaneous notes of the year.

Yellowhead Cranberry Worm on Sweet Gale. The yellowhead cranberry worm, *Teras minuta,* was present this season over cranberry beds near Charlotte. The culture of these beds had been somewhat neglected and sweet gale, *Myrica gale,* had crowded into the beds from all directions. The tips of the sweet gale were everywhere conspicuously spun together and examination showed the culprit to be the yellowhead cranberry worm which was working also in the cranberry vines. The pest was attacking the sweet gale to a much greater extent than it was the cranberry itself. This fact was so marked that it suggested, as apparently practical, a simple remedial treatment for this locality. It was recommended that all of the sweet gale, which was injuring the cranberries by its presence as a weed, should be torn out except strips of it near the edges of the beds which were to be left as a trap. The sweet gale, left as attractive bait for the yellowheads, could be treated to a heavy spray of arsenate of lead early in the spring, in time for the first brood of larvæ, thus killing in small space the majority of the pests. The beds, it should be stated, are in a dry bog and resort

* Insect Life. Vol. IV.. Page 405.

to flowing would mean considerable expense. The same insect was present at Charlotte upon apple trees but not to a great extent.

The Apple Maggot and the Codling Moth. Both these insects are at work in this State to a regrettable and injurious extent. There is considerable confusion among orchard owners as to the character and names of these two pests. The term "apple maggot" is unfortunately applied indiscriminately to the larva of "Trypeta" and the codling moth, and the term "railroad worm" is not much more definite, especially if the trails extend away from the surface of the aple. The present season one man reported that nearly all his apples were "ruined by the 'railroad worm' or 'wire worm' as it is sometimes called." In view of such confusion the following brief statement may not be amiss.

"Apple maggot," "railroad worm," and "Trypeta" should all properly apply to the larva of a striped winged fly, *Rhagoletis (Trypeta) pomonella.* This larva is a *maggot,* a small but plump, white, footless object with head so ill defined that it is difficult to find at all, and the mouth parts reduced to a pair of hooks. The apple maggot works in soft discolored mushy trails anywhere in the pulp of the apple. When these trails lie immediately under the skin of pale-skinned apples they show through like tiny but clearly defined tracks, and the descriptive term "railroad worm" has been given the maggot which travels along these tracks. The trails of the apple maggot never contain little round sawdust-like pellets, and they do not extend into the core of the apple.

The codling moth (*Carpocapsa pomonella*) is a true moth. The fore wings are irregularly streaked with gray and brown, and have a horseshoe marking of copper color at the inner angle. The hind wings are of light yellowish brown. The moth expands about three-fourths of an inch. The larva of this moth is a tiny naked *caterpillar* with clearly defined head region and three pairs of legs upon the segments immediately behind the head. It has the ordinary biting mouth parts of other caterpillars and resembles the closely related leaf folding caterpillars (Tortricids) in its motions, wiggling violently backward when disturbed. The larva of the codling moth makes excavations in the apple, extending them usually into the core itself. These excavations always contain little, round, brown, sawdust-like pellets which are the excretions of the larva.

The apple maggot and the larva of the codling moth are often present in the same apple. Discussions of the life history, habits and remedies of these two pests are given in other available bulletins of this Station and are therefore not repeated here.

Lace Bugs. The recently described * Tingitid, *Corythuca pergandei* Heid., was extremely numerous upon willow and alder (*Alnus incana*) between Bangor and Orono this season.

Infested Spruce Cones. Late in August the cones on the Norway spruces on the campus were observed to be dropping prematurely. Examination showed a general infestation by a Lepidopterous larva about seven-eighths of an inch in length. Some were a uniform purplish brown, others showed a greenish color on the thoracic segments with 2 tiny black spots on the first segment behind the head. These larva began spinning cocoons about the middle of September. The cocoons are the color and transparency of thin white tissue paper. The average length is about one-half inch and they are usually about one-fourth of an inch wide, though sometimes the cocoons are nearly as broad as long. Pupation does not take place at once but the caterpillar, readily seen through the thin cocoon, lies for days in a U-shaped loop. If the cocoon is disturbed, the caterpillars break through and travel off actively and with apparent irritation. The infested cones were prematurely brown in the vicinity of the larval tunnels. The excavations were chiefly at or near the center of the cones, from one to several larvæ being present in a single cone. Through the kindness of Doctor Howard specimens were referrd to Mr. Fiske (Bureau of Entomology, Washington, D. C.), who stated them to be evidently a species of Pinipestis, mature moths being necessary for full determination.

Maggots which were attacking the decaying portion of the cones infested by these caterpillars developed in abundant numbers into *Drosophila amœna* Loew, kindly determined by Mr. D. W. Coquillett. This small red-eyed fly with yellow thorax and dark abdomen, and wings crossed with 2 dusky bands, is not uncommon about decaying fruit.

Harvest fly, *Tibicen rimosa.* A very pretty harvest fly, or cicada, belonging to the same genus as the periodical cicada, was common in the vicinity of Orono from the middle to the latter part of July. (A photograph of this species is given as Fig.

* Proceedings of the Entomological Society of Washington, Vol. VIII. Nos. 1-2.

22.) The head and thorax have clearly defined marks of deep orange yellow, along the posterior margin of each abdominal segment is a narrow but distinct line of the same color, and the wings near the body are clouded also with orange. The expanse of wings averaged about two and one-half inches. The species was kindly determined by Mr. Heidemann as *Tibicen rimosa* Say, var: *noveboracensis* Fitch.

Diamond-back Moth, Plutella cruciferarum, as a Greenhouse Pest. Early in April a complaint came from a greenhouse in Ellsworth of a small green caterpillar which destroyed ten weeks' stock, working on leaves and flowers. Specimens were received with the communication and were bred to the adult stage, part of them proving to be the light form and part the dark form of the Diamond-back. On May 24, a new lot of these larvæ were received from the same source again at work upon the stocks. This species, described with reference to materials bred on stocks in greenhouse, is as follows:

The caterpillars when full grown are three-eighths of an inch in length. The color is a light green with the head concolorous or sometimes shading to yellowish. The median dorsal line is a more vivid green. To the naked eye they appear smooth, but a low power glass reveals stiff dark hairs rising from lighter spots arranged in a regular manner upon the segments. These hairs are most numerous upon the last thoracic segment. The last pair of abdominal pro-legs are extended back horizontally, giving the body a forked appearance. The pupal stage is passed within a very delicate white, gauzy cocoon through which the pupa is readily seen. Some of the specimens reared passed but 6 days in the pupal stage.

The perfect insect is a moth expanding about five-eighths of an inch. The fore wing is ash colored with minute dark spots upon it. A yellowish stripe outlined with a dark line extends along the hinder margin in such a manner that when the wings are closed, 3 light colored diamond-shaped markings are formed. Both pairs of wings are a uniform gray on the under side. The antennæ are marked with alternate rings of white and dark.

The Diamond-back is an imported moth and it occurs frequently upon cabbage and cauliflower in the garden. Doctor Fletcher reports* the Diamond-back to be an incessant and most troublesome pest upon garden stocks and wall-flowers

* Can. Exp. Farms 1890, p. 165.

from about July till the frosts in November. The remedy most frequently recommended is kerosene emulsion.

The greenhouse infestation at Ellsworth started on stocks that had been transplanted from outside and the larvæ were probably taken in with them, successive generations developing within doors. Hand picking proved to be a perfectly effectual remedy though a tedious task.

Six Troublesome Orchard Insects. The yellow-necked caterpillar, *Datana ministra,* and the red-humped caterpillar, *Œdemasia concinna,* have created much alarm in Maine this year. Entire orchards have been despoiled by these pests. Young trees have suffered the worst injury, not because the caterpillars show a preference for them, but because one brood is sufficient to strip a small tree, and the same number of leaves from a large tree does not mean so serious a loss. The bud moth, *Tmetocera ocellana,* is at present doing much damage in Maine orchards. Two species of tussock moths, *Notolophus leucostigma* and *antiqua,* have been abundant in most parts of the State, as has the orchard tent caterpillar.

Limneria guignardi Prov. The red-humped caterpillars have been in the southern counties abundantly attended by an ichneumon parasite, *Limneria guignardi* Prov.* These parasites attack the young caterpillars in the early stages, at which time the caterpillar is just the right size to serve for food for a single parasite. The parasite grub when full grown forms its cocoon within the empty skin of the caterpillar which fits tight over the cocoon. The caterpillar head being still attached, the object is a curious one. When about to emerge the adult parasite gnaws a hole at one end of the cocoon and takes wing. This hole is sometimes near the head and sometimes near the caudal end of the caterpillar skin. See Fig. 23.

Yellow-edge Butterfly. From York to Aroostook counties the spiny caterpillars of the yellow-edge butterfly, *Euvanessa antiopa,* have been common on elm and willow. This species has been almost constantly mistaken for gypsy caterpillars, and has been the cause of numerous false alarms. A brood is occasionally found upon apple trees, but it does not seem likely to become an orchard pest, its preference is so evidently for willow

* Determined by comparison with Canadian material through the kindness of Doctor Fletcher.

FIG. 22. Harvest fly or Cicada, *Tibicen rimosa* Say, *noveboracensis* Fitch. Very slightly enlarged. Photograph of specimen taken at Orono, July 31, 1906.

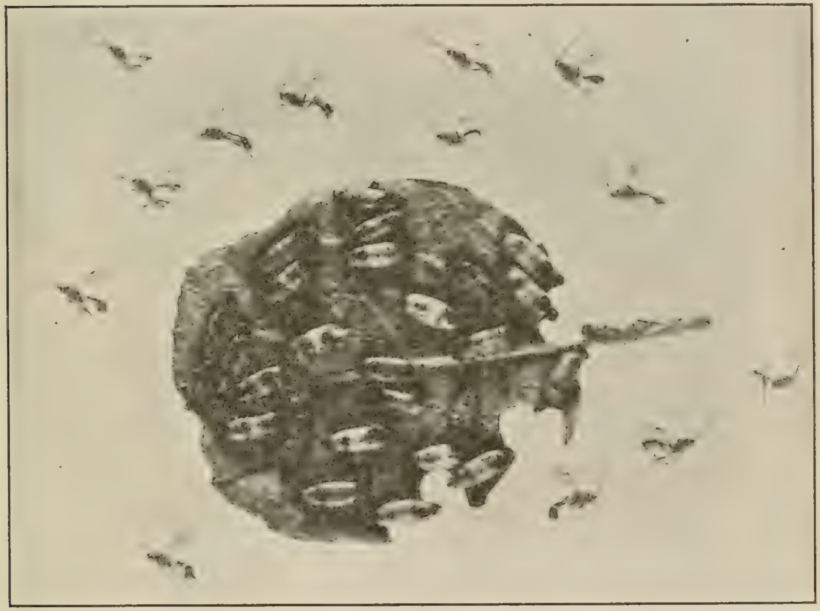

FIG. 23. Parasited specimens of young red humped caterpillars attached to apple leaf, and parasites, (*Limneria guignardi*, Prov.), which emerged from them. Photographed from specimens taken at West Minot, August 29, 1906.

and elm. A Tachina parasite is active against these caterpillars in Maine.

Garden Fleas. In contrast with the past two seasons no observations of the garden flea, *Smynthurus albamaculata,* Harvey, were made. During the early spring, at the time these minute insects have previously been most conspicuous, continuous rains prevented field observations on such insects as these. The account of injury due to this species given in Bulletin No. 123 of this Station, page 220, was the occasion of several requests from specialists in this group for reference to the original description. Professor Harvey's description together with drawings by Mr. J. H. Emerton were published in the Report of this Station for 1896, pages 124-126.

Mosquitoes. There is no adequate record of Maine mosquitoes, although in many parts of the State certain species are excessively troublesome. A few collections were made this season and sent to the Bureau of Entomology, Washington, D. C., where several specialists are at work on this family. Doctor Dyar kindly determined them as follows:

Anopheles punctipennis Say. Orono, July 27 and October 1, about light in house.

Anopheles quadrimaculatus Say. Orono, September 20, in house.

Aëdes fuscus O. S. Orono, July 27.

Aëdes canadensis Theob. Trenton, August 10; Caribou, August 17.

Aëdes sylvestris Theob. Trenton, August 10.

Aëdes sollicitans Walk. Trenton, August 10.

Aëdes abfitchii Felt, *fitchii* Felt, or *subcantans* Felt. (Adults alike—need larvæ to separate). Orono, August 3; Trenton.

All of the species of *Aëdes* except *fuscus* given in the foregoing list were until recently commonly referred to the genus *Culex.*

Insects for Identification. A few, only, of the large number of insects received for identification this season are recorded in the following pages.

Such common, widespread, and constantly recurring forms as the cecropia moth and oyster-shell scale have been omitted. Such information as the increasing parasitism of the red-humped caterpillar has been summarized in a single statement elsewhere in the bulletin rather than listed as 70 or 80 separate items.

INSECTS RECEIVED FOR IDENTIFICATION.

Name.	Date.	Host.	Locality.	Remarks.
Nessus sphinx, *Amphion nessus*	June 14		Orono	Adult.
Galium sphinx, *Deilaphila chamœnerii*	June 14		Orono	Adult.
Wild cherry sphinx, *Sphinx drupiferarum*	June 16		Orono	Adult common.
Thysbe clear-wing, *Hemaris thysbe*	June 18		Surry	Moth on lilac blossom.
Azalea sphinx, *Ampelophaga choerilus*	June 29		Bar Harbor	Male.
Small eyed sphinx, *Paonias myops*	July 14		Orono	Adult.
Big poplar sphinx, *Marumba modesta*	July 13		Orono	Adult.
Pen marked sphinx, *Sphinx chersis*	July 14		Bangor	Female.
Apple sphinx, *Sphinx gordius*	July 17		New Vineyard	Female.
Laurel sphinx, *Sphinx kalmiæ*	July 27		Orono	Adult.
Morning sphinx, *Deilephila lineata*	Aug. 1		Eden	Larvæ full grown.
Twin spotted sphinx, *Smerinthus geminatus*	Aug. 1		Waterford	Adult.
Woodbine sphinx, *Pholus achemon*	Aug. 14	Woodbine	North Berwick	Larvæ "appear every year."
Four horned sphinx, *Ceratomia quadricornis*	Sept. 1		Houlton	Larva.
Walnut Datana, *Datana angusii*	Aug. 22	Walnut	North Berwick	Larvæ numerous, specimen parasited.
Walnut Datana, *Datana angusii*	Aug. 27	Walnut	North Berwick	Trees entirely stripped of leaves.
Unicorn prominent, *Schizura unicornis*	Aug. 22	Apple	Greene	
Unicorn prominent, *Schizura unicornis*	Aug. 28	Apple	Jonesboro	
Unicorn prominent, *Schizura unicornis*	Sept. 1	Apple	Deer Isle	
Unicorn prominent, *Schizura unicornis*	Aug. 14	Apple	North Jay	
Hag moth, *Phobetron pithecium*	Aug. 2		North Buckfield	Cocoon.
Yellowhead cranberry worm, *Teras minuta*	Aug. 29	Cranberry	Charlotte	Larvæ numerous.
Lesser apple leaf folder, *Teras minuta*	June 21	Apple	Foxcroft	Larvæ numerous in orchard.
Fork-tailed caterpillar, *Cerura borealis*	Sept. 7		Weeks Mills	Larva.
Apple Bucculatrix, *Bucculatrix pomifoliella*	Sept. 10	Apple	East Corinth	Ribbed cocoons numerous.
Apple Bucculatrix, *Bucculatrix pomifoliella*	Oct. 15	Apple	Manchester	Ribbed cocoons.
Hickory tiger moth, *Halisidota caryæ*	Sept. 17	Apple	Drew	
Lappet moth, *Tolype velleda*	July 31		East Orrington	Larva full grown.
Beautiful wood nymph, *Eudryas grata*	Aug. 6		Hampden Corner	Adult.
Pearly wood nymph, *Eudryas unio*	July 23		Orono	Adult.
Tussock moth, *Notolophus leucostigma*	Aug. 7	Raspberry	Norridgewock	Much damage.
Fingered dagger moth, *Acronycta dactylina*	Aug. 18		Ellsworth	
———— *Acronycta americana*	Sept. 7	Maple	Bar Harbor	Larva.
Crompton tortoise, *Vanessa j-album*	Sept. 23		Charlotte	Adults very common.
The Relict, *Catocala relicta*	Sept. 9		Orono	Adults on birch bark.
Scalloped Owlet, *Scoliopteryx libatrix*	Feb. 16		Gardiner	Dead moth.

INSECTS RECEIVED FOR IDENTIFICATION—CONCLUDED.

Name.	Date.	Host.	Locality.	Remarks.
Diamond back moth, *Plutella cruciferarum*	April 2	Stocks	Ellsworth	Larvæ destructive in greenhouse.
Budmoth, *Tmetocera ocellana*	June 13	Apple	Turner	Larvæ.
Spruce tortrix, *Tortrix fumiferana*	June 20	White spruce	Bar Harbor	Larvæ.
Larch case bearer, *Coleophora laricella*	June 26	Larix americana	Machias	Larvæ seriously stripping trees.
Cherry tree leaf folder, *Cacœcia cerasivorana*	July 2	Wild cherry	Waterford	
Cherry tree leaf folder, *Cacœcia cerasivorana*	July 13	Wild cherry	Skowhegan	Nest and pupæ.
Oak ugly nest, *Cacœcia fervadana*	Aug. 1	Oak	Bar Harbor	Nest, larvæ and pupæ.
Stalk borer, *Papaipema nitela*	July 14	Sweet corn	Cape Elizabeth	Destroying much.
Primose moth, *Rhodophora florida*	July 27		Orono	Moths common in closed flowers œnothera biennis.
Twice stabbed Lady beetle, *Chilocorus bivulnerus*	Aug. 29	Plant-lice	Ellsworth	Numerous.
15-spotted Lady beetle, *Anatis 15-punctata*	June 7	Plant-lice	New Vineyard	On house plants.
Saw-tooth grain beetle, *Silvanus surinamensis*	March 15	Flour	Farmington	
White grubs, *Lachnosterna*	June 5	Grass roots	Harrison	Grubs worked two acres grass land so that it plowed like old ground.
Asparagus beetle, *Crioceris asparagi*	Sept. 17	Asparagus	Brunswick	¼ acre completely stripped by middle of August.
Beautiful maple borer, *Plaginotus speciosus*	July 18	Maple	Unity	
——— *Malachius æneus*	June 20		Orono	Identified by Dr. Chittenden.
Tortoise beetle, *Coptocycla signifera*	July 24	Convolulus sepium	Orono	Numerous.
Tortoise beetle, *Coptocycla purpurata*	Sept. 13	Convolulus sepium	Orono	Numerous.
Spindle gall, *Pomphigus ulmi-fusus*	July 13	Elm	North Berwick	Numerous.
——— *Pemphigus populimonilis*	Aug. 14	Poplar	Bar Harbor	Galls.
Pineapple gall, *Chermes abietis*	Aug. 1	Spruce	Portland	Galls numerous.
——— *Chionaspis salicis*	Sept. 15	Viburnum alnifolium	Houlton	Thickly infested.
——— *Eulecanium quercitronis*	June 23	White oak	Freedom	In great numbers.
Pear tree Psylla, *Psylla pyricola*	Sept. 1	Pear	Pittsfield	Work on pear leaves.
——— *Pentatoma juniperina*	July 11	Potato	Caribou	Feeding on the stalk, wilting it.
Four-lined leaf-bug, *Pœcilocapsus lineatus*	July 24	Geranium	North Berwick	Troublesome every year.
Tarnished plant-bug, *Lygus pratensis*	Oct. 1	Celery	Portland	Numerous.
Tarnished plant-bug, *Lygus pratensis*	Sept. 15	Potato	Houlton	Enormous numbers.
Tarnished plant-bug, *Lygus pratensis*	Sept. 23	Dahlia	Charlotte	Deformed and buttoned blossoms
Tree hoppers, *Enchenopa binotata*	July 24	Wax work	North Berwick	Great numbers.
Tree hoppers, *Telamona monticola*	Aug. 1	Woodbine	Bangor	

——— *Diedrocephala versuta*	Sept.	10	Birch sprouts	Orono	Great numbers.
——— *Cosmopepla carnifex*	Aug.	4	Mint	Orono	Great numbers.
——— *Cosmopepla carnifex*	Sept.	12	Potato	Caribou	Common.
——— *Cosmopepla carnifex*	Sept.	15	Poplar	Houlton	Abundant.
——— *Banasa dimidiata*	Sept.	15	Willow	Houlton	Adults exceedingly numerous.
——— *Banasa dimidiata*	Sept.	15	Mountain Ash	Houlton	Larvæ adults numerous in berry clusters.
Ichneumon, *Thalessa lunata*	Aug.	22		E. Wilton	Female.
Pear tree slugs, *Eriocampa cerasi*	Sept.	24	Cherry & Plum	Corinna	Bad attack.
Rose slugs, *Monostegia rosæ*	July	18	Rose	Hancock Pt	Ruined appearance of bushes for four years.
Blackberry seed gall, *Diastrophus cuscutæformis*	May	4	Cultivated blackberry	Gardiner	
Giant American saw fly, *Cimbex americana*	Aug.	1	Elm	S. Berwick	Larva full grown.
Solitary wasp, *Eumenes fraternus*	Aug.	14		Gardiner	"Jug nest" and wasp which emerged.
- *Limneria guignardi*	Aug.	29		Augusta	Parasites bred from Œdemasia concinna.
King grasshopper, *Hippiscus tuberculatus*	June	2		Hampden Cor.	Male and female adult.
Sheep bot-fly, *Œstrus ovis*	May	3	Sheep	E. Dixfield	Maggots in nasal passages apparently caused death of sheep.
Maple spot-gall, *Sciara ocellata*	July	2	Maple	Seal Harbor	
Psocids	Aug.	14	Maple and mulberry	N. Parsonfield	On bark in "large droves."
Psocids	Aug.	14	Maple	Alfred	On bark "by thousands."
Psocids	Aug.	18	Maple	Lovell	On bark in great numbers.

APPENDIX.

Annual Report of the State Pomological Society

1906-1907.

CONTENTS.

SECRETARY'S REPORT.

THE 1905 APPLES.

So far as it was possible to do so, many apples grown last year were held in storage until after our report for 1905 was made up, hence it seems proper to refer to their sale. The prices in some cases were well nigh record-breakers and deserve mention in this report.

The six hundred barrels grown in the $2850 orchard referred to in last year's report were sold for $3.50 per barrel. So that the crop went a long way toward returning the purchase money in less than one year from the purchase of the orchard. This year (1906), it may be added, this orchard produced two hundred barrels.

One grower in Skowhegan had 264 barrels of Ben Davis for which he received $1056 at the railroad station in that town.

Eighty barrels of Gravensteins from the Pope orchard returned a check for $360.

A carload of apples from the Staples' orchard, containing ninety-one barrels of No. 2 and 110 barrels of No. 1, sold in the Boston market for a net sum of $911.91. The Northern Spy in the lot sold for $8 per barrel. Hall & Cole stated that this was the most money paid for a carload of apples sold in Boston during the season.

BETTER CULTURE.

Our people are beginning to realize the value of the orchard, and they realize as never before that to produce the best results the orchard must have the best treatment. It is interesting to note that the most productive orchards this year are those that have received the most intelligent care. As one goes about over the State the evidence of this accumulates. More orchards are plowed and harrowed; more orchards are the feeding grounds

of sheep or hogs; more orchards are dressed with chemical fertilizers. The trees themselves show the care, and when questioned by the observer point to the treatment they receive. Nearby orchards, neglected as they are, bear witness to the same. "Treat me well," the tree says, "and give me a fair chance and I will fill the barrels with the choicest Maine fruit."

MORE ORCHARDS.

The Secretary thinks more trees have been set this year than any previous year in the decade. It seems unfortunate that it was necessary to go out of the State for the stock, as the careless treatment of nursery stock in other states threatens the introduction of the most injurious insects and fungi. One lot of trees was so badly infected, it was destroyed root and branch after it reached the purchaser. Though there were several varieties, inquiry convinces your Secretary that the Stark was a leading variety, due perhaps to the influence of the salesman.

THE 1906 FRUIT CROP.

Although the crop for 1906 is much smaller than last year, the fruit itself is of superior quality, being large and highly colored. The early figures sent out were much inflated and misleading and those tabulated later credit Maine with a crop of 700,000 barrels—more by nearly 200,000 barrels than last year. Perhaps these figures will do us no injury, but we fail to discover any advantage in such inflation.

The prices started at one dollar and fifty cents and have slowly advanced to about $2.00 and we predict a little more later on for choice lots.

SMALL FRUITS.

There was a small crop in most cases of strawberries. Conditions were not altogether favorable, but the fruit that set ripened up well. The cold weather—frost—injured some beds, and other beds were injured by worms. The prices were good and the quality better than in ordinary seasons.

Raspberries, when not protected, winter killed, so that there were few berries for any one. The expense in labor to protect raspberry canes is not great, and the local markets in Maine are rarely well supplied. It is believed that the increased yield

would pay liberally for the work. But a good variety, hardier than the Cuthbert, is much needed in Maine.

Blackberries were plenty wherever there were bushes to bear them, and they were of excellent quality. The Snyder and Agawam were both large and delicious. They should be more generally grown.

Currants bore finely, but gooseberries were injured by the frost in many cases.

MEETINGS OF EXECUTIVE COMMITTEE.

There have been two meetings of the Executive Committee during the year. The first was held at the Cony House, Augusta, January 19, being also the meeting for closing up the affairs of the society for the previous year. The second was held at the Elm House, Auburn, July 7. At the former meeting the work for the year was outlined and preliminary arrangements were made for a Summer Meeting and the Annual Meeting and Exhibition.

THE INSECT SITUATION.

There has been and is the deepest solicitude among fruit growers over the insect situation in Maine. Fruit trees have been carefully examined for insects, and it would seem from the reports sent in that never before were the fruit trees so badly infected. Fortunately these insects were not the most troublesome, and when found they have been destroyed. This is the chief lesson the authorities have endeavored to teach, and it is gratifying to note the success thus far. The brown-tail moths have been largely under control, though they have made their appearance in many towns in the southwestern part of the State, along the coast and in some interior towns. They have not been numerous enough as yet to seriously injure our fruit trees. The danger threatens more and more, and the duty of every one to protect his own trees becomes of the highest importance. The presence of any insect pest should be reported promptly to the authorities, and there should be the most complete co-operation with them. No gypsy moths have yet been reported in the State, but we may expect to find more or less when careful search comes to be made. Nor has there been reported any San Jose scale. Many of our orchards are already

infested by troublesome insects, as well as injurious fungi. The time is at hand when attention should be given to these, and I am satisfied this is one of the most important needs at this time.

SUMMER MEETING.

By invitation of President George E. Fellows the Summer Meeting was held on the campus of the University of Maine, August 21st. For several days the weather was extremely hot and humid, but there visited the grounds during the day 150 or more, coming from different parts of the State, no less than eight counties being represented by one or more persons. The University officers gave the visitors a very cordial welcome. There was opportunity for going through the buildings and looking over the grounds.

After a lunch upon the campus the visitors repaired to the chapel and an impromptu programme of speaking was in order. A condensed report of this meeting appears elsewhere in this volume of transactions. The Secretary would here acknowledge the valuable assistance of Prof. W. M. Munson in advertising and perfecting the details for this most valuable meeting.

THE ANNUAL MEETING.

The Annual Meeting was held in Harrison, Nov. 13, 14 and 15. Locally there was the deepest solicitude on the part of the citizens of Harrison to make this meeting a red-letter day in the history of the town. In every direction there was a hearty co-operation with the Executive Committee to perfect the arrangements for the meeting, and during my official connection with the Society we have never found all the numerous details so perfectly carried out and everything in such perfect readiness for our coming.

The meetings were held in the new and elegant hall of Lakeside Grange, which was well filled during each session. The dining hall served as the exhibition room for the fruit, of which there was an excellent display. The arrangement of the tables was good, and the general quality of the fruit was fine, being large and well colored.

In the programme there were some new features introduced. It was voted by the Society last year to devote an entire session to the discussion of the topic: "How can the meetings and

exhibits of the Society be made of the greatest educational value?" Your Committee did not feel warranted in devoting a whole session to this subject, important though it may be. The session as arranged provided for short greetings from the representatives of other Societies who might be present, and I am glad to note that all seemed to enjoy hearing somewhat of the work of kindred organizations. The session closed with Prof. Munson's paper on "A Horticultural Use for Abandoned Lands."

Another departure was the holding of a banquet for one of the evening sessions. Years ago when the Society held its exhibition in Portland there was a fruit banquet that was much enjoyed. The banquet so daintily served by the members of Lakeside Grange will long be remembered as the most delicious "love-feast" in the history of the Society. The discourse following made it "the sweetest banquet of the mind."

D. H. KNOWLTON,
Secretary.

OFFICERS FOR 1906.

President.

Z. A. GILBERT, North Greene.

Vice Presidents.

D. P. TRUE, Leeds Center.
EDWARD L. WHITE, Bowdoinham.

Secretary.

D. H. KNOWLTON, Farmington.

Treasurer.

E. L. LINCOLN, Wayne.

Executive Committee.

The President and Secretary, *ex-officio*; C. A. Arnold, Arnold; Will E. Leland, East Sangerville; V. P. DeCoster, Buckfield.

Trustees.

Androscoggin county, A. C. Day, South Turner.
Aroostook county, Edward Tarr, Mapleton.
Cumberland county, John W. True, New Gloucester.
Franklin county, E. E. Hardy, Farmington.
Hancock county, Chas. G. Atkins, Bucksport.
Kennebec county, E. R. Mayo, Hallowell.
Knox county, Alonzo Butler, Union.
Lincoln county, H. J. A. Simmons, Waldoboro.
Oxford county, F. H. Morse, Waterford.
Penobscot county, W. M. Munson, Orono.
Piscataquis county, C. C. Dunham, Foxcroft.
Sagadahoc county,————
Somerset county, Frank E. Nowell, Fairfield.
Waldo county, Fred Atwood, Winterport.
Washington county, D. W. Campbell, Cherryfield.
York county, J. Merrill Lord, Kezar Falls.

Member Experiment Station Council.

CHARLES S. POPE, Manchester.

MEMBERS OF THE SOCIETY.

NOTE.—Any errors or changes of residence should be promptly reported to the Secretary. Members will also confer a favor by furnishing the Secretary with their full Christian names where initials only are given.

LIFE MEMBERS.

Andrews, A. Emery ....Gardiner
Andrews, Charles E..............Auburn
Arnold, C. A ....Arnold
Atherton, Wm. P..............Hallowell
Atkins, Charles G ....Bucksport
Atwood, Fred ....Winterport
Averill, David C...................Temple
Bailey, W. G ....Freeport
Bennoch, John E .... Orono
Bickford, Lewis I.......Dixmont Center
Bisbee, George E................ Auburn
Blanchard, Mrs. E. M ....Lewiston
Blossom, L. H.............Turner Center
Boardman, Samuel L............Bangor
Briggs, John.......................Turner
Burr, John.........................Freeport
Butler, Alonzo.......................Union
Chadbourne, C. L........North Bridgton
Chandler, Mrs. Lucy A ....Freeport
Chase, Henry M., 103 Federal St., Portland
Corbett, Hermon ....Farmington
Crowell, Mrs. Ella H.........Skowhegan
Crowell, John H.............Farmington
Cummings, Mrs. Anthony ....Auburn
Dana, Woodbury S..............Portland
Dawes, S. H......................Harrison
DeCoster, Virgil P ....Buckfield
Denison, Mrs. Cora M ....Harrison
DeRocher, Peter ......Bradentown, Fla.
Dirwanger, Joseph A...........Portland
Dunham, W. W ....North Paris
Dyer, Milton ....Cape Elizabeth
Emerson, Charles L ....South Turner
Farnsworth, B. B ....Portland
Frost, Oscar F.................Monmouth
Gardiner, Robert H.............Gardiner
George, C. H ....Hebron
Gilbert, Z. A ....North Greene
Goddard, Lewis C ....Woodfords
Grover, Franklin D ....Bean
Gulley, Alfred G............Storrs, Conn.
Hackett, E. C ....West Gloucester
Hall, Mrs. H. A ....Brewer
Hanscom, John ....Saco
Hardy, E. E ....Farmington
Harris, William M................Auburn
Hoyt, Mrs. Francis.............Winthrop
Jackson, F. A....................Winthrop
Jones, J. H ....Mercer
Keene, Charles S..................Turner
Knowlton, D. H..............Farmington
Lapham, E. A......................Pittston
Leland, Will E ....East Sangerville
Lincoln, E. L ... .Wayne
Litchfield, J. H ....Auburn
Litchfield, Mrs. L. K...... ....Lewiston
Lombard, Thurston M ....Auburn
Lord, J. Merrill ....Kezar Falls
Luce, Willis A ....Columbia Falls
Macaulay, T. B ....Montreal, Can.
McAllister, Zaccheus.......West Lovell
McCabe, George L.........North Bangor
McLaughlin, Henry ....Bangor
McManus, John...............Brunswick
Mitchell, Frederick H ....Turner
Moody, Charles H..................Turner
Moore, William G ....Monmouth
Moor, F. A ....Waterville
Morse, F. H.....................Waterford
Morton, J. A ....Bethel
Munson, W. M.......................Orono
Page, F. W ....Augusta
Palmer, George L .. ..South Livermore
Parsons, Howard G.......Turner Center
Pope, Charles S..............Manchester
Prince, Edward M....West Farmington
Pulsifer, D. W ....Poland
Purington, E. F..............Farmington
Richards, John T................Gardiner
Ricker, A. S..........................Turner
Roak, George M ....Auburn
Sanborn, Miss G. P..............Augusta

LIFE MEMBERS—Concluded.

Sawyer, Andrew S.......Cape Elizabeth
Seavy, Mrs. G. M ....Auburn
Simmons, H. J. A............Waldoboro
Skillings, C. W ....North Auburn
Smith, Henry S ....Monmouth
Snow, Mary S ....Bangor
Stanley, H. O ....Winthrop
Starrett, L. F..... ....Warren
Stetson, Henry ....Auburn
Stilphen, Asbury C ....Gardiner
Taylor, Miss L. L..(Lakeside) Belgrade
Thomas, William W .. ..Portland
Thomas, D. S ....North Auburn
Thurston, Edwin......West Farmington
Tilton, William S..........Boston, Mass.
Townsend, Mrs. B. T ....Freeport
True, Davis P ....Leeds Center
True, John W............New Gloucester
Turner, E. P...............New Vineyard
Twitchell, Geo. M ....Auburn
Vickery, James ....Portland
Vickery, John ....Auburn
Wade, Patrick....................Portland
Walker, Charles S ....Peru
Walker, Elmer V...................Oxford
Waterman, Willard H......East Auburn
Waugh, F. A ....Amherst, Mass.
Wheeler, Charles E ....Chesterville
White, Edward L ....Bowdoinham
Yeaton, Samuel F.....West Farmington

ANNUAL MEMBERS, 1904.

Allen, S. L ....Fairfield
Arnold, M. F.........................Carmel
Beal, S. H........................Skowhegan
Benson, Mrs. G. S ....Skowhegan
Burkett, Andrew.....................Union
Butler, L. F ....Madison
Cole, J. E ....Union
Daggett, E. L ....Union
Danforth, F. G................Skowhegan
DeCoster, V. P..................Buckfield
Frost, J. H ....188 Pearl St., Portland
Gleason, F. A.........................Union
Greenleaf, A. C... ....Farmington
Hall, Chas. G......... ......Cedar Grove
Jepson, Albert E..........Norridgewock
Knowlton, J. B ....Farmington
Leland, Will E... ....East Sangerville
Lenfest, Mrs. F. H ....Union
Lincoln, Mrs. E. L ....Wayne
Mayo, E. R.......................Manchester
McAllister, Z ....West Lovell
Merchant, S. L................ .Winthrop
Nowell, F. E . ...Fairfield
Sanborn, C. E.................Skowhegan
Sherman, Mrs. Clara E ....Union
Shurtleff, S. G..........South Livermore
Swan, J. A ....Skowhegan
Tarr, Edward....................Mapleton
Toothaker, L. P....... ....Etna
Tucker, Benj.......................Norway
Warren, Henry P ....Albany, N. Y.
Waterman, L. C ....Buckfield
White, Mrs. Charles ....Skowhegan
White, Edward L ....Bowdoinham
White, P. C ....Skowhegan
Whitman, W. C. & Son.....South Turner

ANNUAL MEMBERS, 1905.

Abbott, S. E............. ....Bethel
Bass, Mary A ....Wilton
Berry, W. F.........................Canton
Briggs, Arthur B..................Canton
Bryant, C. A ....Livermore Center
Campbell, D. W ....Cherryfield
Chase, Solon................Chase's Mills
Craig, William....................Auburn
DeCoster, Mrs. V. P............Buckfield
Ellis, Mrs. Kate B ....Fairfield
Fairbanks, A. E........North Monmouth
Goodale, G. C....................Winthrop
Greenleaf, A. C..............Farmington
Hardy, E. E.....................Farmington
Hitchings, E. F................Waterville
Leland, Will E..........East Sangerville
Lincoln, Mrs. E. L ....Wayne
Mayo, E. R.........................Hallowell
McLatchey, R. E ..46 Clinton St., Boston
Mendell, Mrs. C. E ....Hartford
Merchant, S. L..................Winthrop
Nowell, F. E ....Fairfield
Perley, F. B....................Vassalboro
Scales, Lilla M.. ....Temple
Shurtleff, S. G..........South Livermore
Smith, Mrs. F. A ....Canton
Spaulding, Stephen.....North Buckfield
Staples, George W................Temple
Stetson, T. B. W...................Canton
Toothaker, L. P........................Etna
Tucker, Benjamin................Norway
Virgin, G. H ....Canton
Virgin, Mrs. G. H..................Canton
Walker, Mrs. F. L..................Canton
Wallingford, John..................Auburn
Washburn, C. C ....Mechanic Falls
White, Edward L..........Bowdoinham
Whittemore, F. H ......Livermore Falls

ANNUAL MEMBERS, 1906.

Arnold, F. A	Arnold
Bennett, Elizabeth A	Harrison
Breed, W. O	Harrison
Burnell, R. A	West Baldwin
Chadbourne, J. A	North Bridgton
Chadborune, W. C	North Bridgton
Cobb, W. F	Turner Center
Craig, William	Auburn
Dorsey, Maxwell J	Orono
Dunham, C. C	Foxcroft
Flint, Mrs. John B	Harrison
Frost, H. F	Wayne
Goodale, G. C. & W. E	Winthrop
Greene, J. L	Harrison
Guptill, Florence	Topsham
Hobart, O. R	Auburn
Leavitt, L. C	Kezar Falls
Mayo, E. R	Hallowell
Merchant, S. L	Winthrop
Nowell, Frank E	Fairfield
O'Neil, Joshua H	Portland
Pike, Albert J	Wayne
Pike, J. M	Wayne
Shurtleff, S. G	South Livermore
Tarr, Edward	Mapleton
Thorpe, B. F. W	Augusta
Tucker, Benjamin	Norway
Warren, Jessie B	Harrison
Washburn, C. C	Mechanic Falls
Waterman, L. C	Buckfield
Watson, Bernice	Gardiner
Wilbur, Georgine V	Phillips

REPORT OF THE EXECUTIVE COMMITTEE.

The various reports of officers and the papers published with this in the Annual Transactions will give a comprehensive idea of the work during the year 1906. There has been an effort on the part of the executive committee to intensify certain features of the work, at the same time we are well aware that there are many other lines of work that could be followed up to the advantage of the fruit industry in the State. In connection with the Farming Specials that were run over the railroads in the State we distributed 1,000 eight-page circulars setting forth the objects of the society and soliciting the co-operation of all fruit growers in the State. While there has not been any large increase in our membership we feel that the effect was beneficial.

The money of the society has been wisely expended, and as will be seen, it is for money paid by the committee in some way for travel and other expense, aside from the small salaries allowed the secretary and treasurer and the money paid in prizes at our exhibition. Stating it in other words the work of the officers has been largely done gratuitously. Each of the committee have spent several days in attending the meetings, and the secretary will bear witness that this time has been cheerfully given.

At all our meetings and elsewhere we have urged fruit growers to become members of the society Reference to the figures will show that from new members we have received the past year $112. Of this sum $80 will be added to our Permanent Fund, which now amounts to $1,640. The following resume shows the financial situation for the year:

RECEIPTS.

Balance in treasury, January 1, 1906	$61 45
State stipend for 1906	1,000 00
Interest on permanent fund	66 61
Interest on deposit	15 86
Life members	80 00
Annual members	32 00
Fruit sold at Harrison	1 00
	$1,256 92

EXPENDITURES.

Executive committee	$125 66
Treasurer	15 70
Salary of secretary	150 00
Salary of treasurer	25 00
Speakers at annual meeting	66 50
Judges	36 51
Postage	27 54
Premiums at annual exhibition	329 50
Annual meeting	17 00
Stenographer	60 87
Binding transactions	28 60
Printing and Stationery	71 60
Hotel bills—officers and speakers	80 50
Freight	9 63
Express	18 04
Paper for exhibition tables	4 40
Badges and box of Hood River apples	8 75
	1,075 80
Balance	15
	$1,075 95
Outstanding orders paid	180 97
	$1,256 92

RESOURCES.

Cash in treasury	$ 15
Due from State for 1907	1,000 00
Permanent fund	1,640 00
	$2,640 15

LIABILITIES.

Due permanent fund	130 00
	$2,510 15

PERMANENT FUND.

Invested as shown by treasurer's report	$1,510 00
Due from society	130 00
	$1,640 00

Z. A. GILBERT,
D. H. KNOWLTON,
C. A. ARNOLD,
V. P. DECOSTER,
WILL E. LELAND,
Executive Committee.

REPORT OF TREASURER.

E. L. Lincoln, Treasurer, in account with Maine State Pomological Society.

1906. Dr.	
January 20, balance for the year 1905	$61 45
To received from First National Bank of Farmington interest on stock	12 00
To received from Albert J. Pike, Wayne, annual fee	1 00
February 10, To received from Joshua H. O'Neil, Portland, annual fee	1 00
March 2, State stipend	1,000 00
July 2, To received from First National Bank of Farmington interest on stock	12 00
May 13, To received from Georgine V. Wilber of Phillips, annual fee	1 00
August 11, To received from H. F. Frost, Wayne, annual fee	1 00
25, To received from Edward L. White, life member	10 00
September 8, To received from O. B. Hobart of Auburn, annual fee	1 00
28, To received from J. M. Pike of Wayne, annual fee	1 00
November 2, to received from Livermore Falls Trust and Banking Company interest of certificate of deposit	11 78
17, to received from Alfred G. Gulley, life member	10 00
to received from S. G. Shurtleff, South Livermore, annual fee	1 00
November 20, To received from J. Merrill Lord, Kezar Falls, life member	10 00
To received from Zaccheus McAllister of Lovell, life member	10 00
To received from E. P. Turner, New Vineyard, life member	10 00
December 5, To received from Florence Guptill of Topsham, annual fee	1 00
To received from E. E. Hardy of Farmington, life member	10 00
6, To received from E. R. Mayo of Hallowell, annual fee	1 00
To received from S. L. Merchant of Winthrop, annual fee.	1 00
November 20, To received from W. O. Breed of Harrison for annual fees	1 00
To received from J. A. Chadbourne of No. Bridgton, annual fee	1 00
To received from L. C. Leavitt, of Kezar Falls, annual fee.	1 00
To received from Benjamin Tucker of Norway, annual fee	1 00
To received from Wm. Craig of Auburn, annual fee	1 00
To received from Maxwell J. Dorsey of Orono, annual fee.	1 00
To received from W. F. Cobb of Turner Center, annual fee	1 00
To received from C. C. Washburn of Mechanic Falls, annual fee	1 00
To received from B. F. W. Thorpe of Augusta, annual fee	1 00
To received from F. E. Nowell of Fairfield, annual fee	1 00
To received from J. L. Green of Harrison, annual fee	1 00
To received from sale of fruit at Harrison	1 00

December 1,	To received from C. C. Dunham of Foxcroft, annual fee..	$1 00
	To received from F. A. Arnold of Arnold, annual fee	1 00
	To received from Elizabeth A. Bennett of Harrison, annual fee	1 00
	To received from R. A. Burnell, West Baldwin, annual fee	1 00
	To received from C. L. Chadbourne of Harrison, life member	10 00
4,	To received from W. C. Chadbourne of No. Bridgton, annual fee	1 00
	To received from Cora M. Denison Harrison, life member	10 00
	To received from Mrs. John B. Flint of Harrison, annual fee	1 00
	To received from G. C. & W. E. Goodall, Winthrop, annual fee	1 00
7,	To received from Livermore Falls Trust & Banking Co., interest on certificate of deposit	4 08
8,	To received from Edward Tarr of Mapleton, annual fee..	1 00
	To received from Jessie B. Warren of Harrison, annual fee	1 00
	To received from L. C. Waterman of Buckfield, annual fee	1 00
	To received from Bernice Watson of Gardiner, R. F. D., annual fee	1 00
27,	Interest on Savings Bank deposits........	42 61
		$1,256 92

CR.

January 20,	by paid W. G. Tibbitts, order No 900, for board of Executive Committee	$9 50
	By paid D. H. Knowlton, order No. 895, expense at Augusta as Secretary	3 77
	By paid Z. A. Gilbert, order No. 899, expense as President at Augusta........	3 05
	By paid C. A. Arnold, order No. 897, expense as Executive Committee, Augusta........	3 75
	By paid V. P. DeCoster, order No. 896, expense as Executive Committee, Augusta........	4 60
	By paid E. L. Lincoln, order No. 897, expense as Treasurer, it being for traveling at Augusta, extension case and postage for 1905........	7 60
March 5,	By paid Knowlton & McLeary, order No. 893, for printing and stationery for 1905........	55 97
	By paid D. H. Knowlton, order No. 883, salary, being balance for the year 1905	100 00
31,	By paid E. L. Lincoln, order No. 894, salary for the year 1905	25 00
July 7,	By paid D. H. Knowlton, order No. 906, postage and expense	26 01
	By paid D. H. Knowlton, order No. 907, expense and board Executive Committee	2 66
	By paid C. A. Arnold, order No. 909, expense as member Executive Committee	4 50
	By paid Will E. Leland, order No. 910, expense as Executive Committee........	5 26
	By paid Smith & Reid, order No. 911, binding Transactions.	28 60
	By paid V. P. DeCoster, order No. 908, expense as Executive Committee........	2 00
August 25,	By paid Will E. Leland, order No. 905, expense at Orono....	2 50
	By paid C. A. Arnold, order No. 903, expense at Orono......	2 00
	By paid Z. A. Gilbert, order No. 912, expense as President at Orono........	10 67

August 25,	By paid V. P. DeCoster, order No. 904, expense at Orono....	$11 70
	By paid D. H. Knowlton, No. 902, expense as Secretary......	7 75
	By paid D. H. Knowlton, order No. 901, in part salary as Secretary 1906........	50 00
October 1,	By paid Will E. Leland, order No. 930, for expense moving Society's boxes from Mrs. Libbey's........	3 40
8,	By paid L. B. Raynes, order No.913, service as stenographer at Orono........	8 27
24,	By paid Whitehead & Hoag Co., order No. 914, expense for badges........	3 50
November 17,	By paid Alfred G. Gulley, order No. 923, expense as speaker and service at Harrison........	26 90
	By paid Bessie M. Rupert, order No. 921, expense as speaker at annual meeting........	4 00
	By paid C. A. Arnold, order No. 918, expense at annual meeting........	10 60
	By paid V. P. DeCoster, order No. 920, expense as Executive Committee, Harrison........	6 68
	By paid Will E. Leland, order No. 926, expense as Executive Committee, Harrison........	8 00
	By paid Z. A. Gilbert, order No. 919, expense as President at Harrison........	1 85
	By paid Wm. W. Higgins, order No. 917, apples purchased to show style of packing........	3 25
	By paid Miss Bernice Watson, expense as speaker, order No. 922........	8 00
	By paid Maine Farmer Pub. Co., printing posters, annual meeting, order No. 918........	2 98
	By paid David Kneeland, board of officers at Harrison, order No. 929........	68 00
	By paid Mary W. Gray, order No. 933, service as Clerk at annual meeting........	4 00
	By paid Guy E. Davis, order No. 936, service as janitor at Harrison........	3 00
	By paid S. H. Dawes, expense incurred for express and other items, order No. 931, at Harrison........	7 75
	By paid W. O. Breed, expense for music at annual meeting, Harrison........	10 00
	By paid H. A. Shorey & Son, order No. 916, publishing posters for annual meeting........	5 00
	By paid E. L. Lincoln, expense traveling as Treasurer at Harrison, order No. 924........	5 10
	By paid Dr. George M. Twitchell, expense as Committee on "Fruit Marks," acct. order No. 927........	6 10
	By paid S. G. Shurtleff, order No. 935, travel and service as judge of fruit........	6 35
	By paid Maxwell J. Dorsey, order No. 925, expense as speaker at annual meeting, Harrison........	9 10
20,	By paid D. H. Knowlton, order No. 928, expense as Secretary to date at annual meeting, Harrison........	37 45
	By paid S. T. Maynard, No. 934, travel and service as a judge of fruit at annual meeting........	30 16
	By paid Wm. Craig, order No. 938, travel at annual meeting........	2 75
December	By paid E. L. Lincoln, awards at Harrison meeting.......	329 50
November 16,	By paid Mrs. V. P. DeCoster, to travel and service at Harrison meeting, order No. 932........	9 65
December 27,	By paid Will E. Leland for expense as Executive Committee at Augusta........	6 26

December 27,	By paid V. P. DeCoster, expense and cash paid for freight and travel, order No. 947	$6 80
	By paid D. H. Knowlton, expense as Secretary, No. order 942	6 12
	By paid D. H. Knowlton, order 941, salary for 1906 in full	100 00
	By paid Knowlton & McLeary Co., printing, etc., No. 943	63 62
	By paid Miss L. B. Raynes, services as Stenographer, annual meeting, order No. 939	52 60
	By paid E. L. Lincoln, order No. 946, salary as Treasurer..	25 00
	By paid E. L. Lincoln, expense as Treasurer	8 20
	Balance	15
		$1,256 92

PERMANENT FUND FOR THE YEAR 1906.

By members' fee as reported for 1905		$1,560 00
Fees received in 1906:		
Edward L. White	$10 00	
Alfred G. Gully	10 00	
J. Merrill Lord	10 00	
Zach McAllester	10 00	
E. P. Turner	10 00	
E. E. Hardy	10 00	
C. L. Chadbourne	10 00	
Cora M. Denison	10 00	
		$1,640 00

Permanent fund invested as follows:		
Four shares stock First National Bank of Farmington	$400 00	
Deposit in Augusta Saving Bank	550 00	
Deposit in Augusta Trust Co., and Winthrop Branch	560 00	
Due permanent fund life fee for 1905	50 00	
Due permanent fund life fee for 1906	80 00	
		$1,640 00

Respectfully submitted,

ELLIS L. LINCOLN, Treasurer.

BUSINESS TRANSACTIONS.

MEETINGS OF EXECUTIVE COMMITTEE.

AUGUSTA, January 19, 1906.

Voted, To hold an Orchard Meeting—time and location referred to Secretary.

Voted, To refer location of Annual Meeting to Mr. Gilbert, to be reported at next meeting.

Voted, To hold Annual Meeting the week of November 11th.

Voted, To instruct the Secretary to have 1500 copies of Schedule of Premiums printed previous to the proposed Orchard Meeting.

Voted, That the Secretary and Treasurer be authorized to withdraw one thousand dollars from deposits now on interest for investment, and that they be instructed to invest the same in such interest-bearing securities as may meet the approval of the Executive Committee.

Revised the Schedule of Premiums for 1906.

AUBURN, July 7, 1906.

Secretary presented invitations for the Annual Meeting: one from citizens of Harrison by S. H. Dawes; a verbal invitation from parties in Waterville; a written invitation from Winthrop Grange to hold the meeting in Winthrop; a verbal invitation from C. L. Jones to hold the Annual Meeting in Corinna.

Voted, To hold the Annual meeting in Harrison.

Voted, To hold the Field Meeting with the University of Maine.

AUGUSTA, December 27, 1906.

At this meeting the Treasurer presented his report for the year, and the same was audited and approved.

The Executive Committee made up their report of the year's work, together with a statement of the financial condition of the Society, which appears in full in this volume.

Public Meetings.

FIELD MEETING.

The Field or Summer Meeting of the Society was held on the campus of the University of Maine, Orono, August 21st.

After looking over the grounds and partaking of a basket picnic on the campus, the party assembled in the chapel, where there were informal talks by several speakers, a summary of which appears elsewhere in this volume. Among other objects of interest to visitors were several spraying outfits.

Although no formal expression of thanks was made, each and all were delighted with the cordial reception and the opportunity afforded for the study and investigation of the work being done in the way of horticulture.

ANNUAL MEETING.

The Annual Meeting and exhibition of fruits and flowers were held in the new and commodious hall of Lakeside Grange, Harrison, November 13, 14 and 15.

The 13th was devoted to the arranging of the exhibition. The programme for the 14th and 15th was as follows:

Wednesday, Opening Session at 11 A. M.—Address of Welcome, Alphonzo Moulton, Harrison; Response, Charles E. Wheeler, Chesterville; President's Annual Address, Hon Z. A. Gilbert, North Greene; Appointment of Committees.

Wednesday Afternoon—Greetings from other Societies. How can the Meetings and Exhibits of the Society be made of the greatest educational value? Discussion opened by Edward L. White, Bowdoinham; continued by John W. True, New Gloucester, Chas. S. Pope, Manchester, and others. A Horticultural Use for Abandoned Lands, Prof. W. M. Munson, Orono.

Wednesday Evening—A grand banquet was served by Lakeside Grange at 7 o'clock in Grange Hall.

Thursday—Annual Meeting: Report of Treasurer, E. L. Lincoln, Wayne; Report of Secretary, D. H. Knowlton, Farmington; Report of Executive Committee.

Report of Committee on the following Resolve passed at the last Annual Meeting, Dr. Geo. M. Twitchell, Auburn, Committee:

That this Society, recognizing the substantial growth of our fruit industry and realizing the necessity for a more critical grading of the stock, for the protection of the grower, declares in favor of national legislation looking to a Fruit Marks Act, and authorizes the appointment of a committee whose duty it shall be to correspond with the officers of the Fruit Growers' Associations in the several states, and if a general sentiment is found favoring such action to arrange a conference for the purpose of outlining national legislation, said committee to be authorized to expend a sum not to exceed fifty dollars for postage and necessary printing and expenses, a full report to be made at the next annual session of this Society.

Report of Committee on Fruit Packages. The following vote was passed at the last annual meeting of this Society, E. L. Lincoln, L. H. Blossom, Chas. S Pope, Committee:

To refer back to the same committee the question of the size of package to be adopted, and further that this committee be instructed to, if possible, agree with representatives of other New England and New York Associations as to the size of box to be adopted by all societies, and report at the next meeting.

THURSDAY AFTERNOON—Our Round Table. Best and most profitable apples for Piscataquis County, Will E. Leland, East Sangerville; A Massachusetts Man on a Maine Farm, W. O. Breed, Harrison; How to Pack the Apple, F. B. Perley, Cross Hill; Why not Grow More and Better Fruit in Maine? William Craig, Auburn; What a Tree Told Me, Dr. Geo. M. Twitchell, Auburn; The Brown-tail's Parasites, Prof. E. F. Hitchings, Waterville; The Cold Storage Problem, Prof. Maxwell J. Dorsey, Orono.

Address, Recent Pointers for the Apple Grower, Prof. Alfred G. Gulley, Storrs, Conn.

THURSDAY EVENING—Ladies' Night. Music; My Nature Studies, Miss Bernice Watson, Gardiner; How to Grow Dahlias in Maine, Miss Bessie M. Rupert, Portland; Home Industries for the Farmer's Daughter, Mrs. V. P. DeCoster, Buckfield; Music.

BUSINESS TRANSACTED.

At the opening session, Charles E. Wheeler, John W. True and F. H. Morse were chosen a Committee on the President's Address.

This committee having attended to the duty assigned them, offered the following report, which was accepted:

"First, we would recommend, in view of the increased fruit industry and the demand for extra work along the lines of horticulture, that the Executive Committee use such means as in their judgment they deem best to secure an increased appropriation for our Society from the State.

"Second, in view of the increased allotment of funds from the general government to our Experiment Station, we would demand increased work along the lines of horticulture.

"Third, that we feel it due our Society that a written report be presented at each annual meeting by our member of the Experiment Station Council.

"Fourth, that we urge our Executive Committee to use such measures as they deem best to secure aid and legislation regarding the insect pests of our State.

Fifth, that our Society endorse all that our President has said in commendation of our State Commissioner of Agriculture in his fight against the brown-tail moth and other injurious pests.

"All of which is respectfully submitted."

S. G. Shurtleff, Chas. S. Pope and Edward L. White were appointed a Committee on Resolutions. Having attended to the duty assigned them, at a later session they offered the following resolutions, which were accepted:

"*Resolved,* That the Maine Pomological Society desire to extend their thanks to Lakeside Grange for the use of their hall during this session of their Annual Meeting; and to the citizens of Harrison for their uniform courtesy to the members of this Society.

"*Resolved,* That we wish to express our thanks in particular to the Committee of Arrangements and to the Banquet Committee, also to the proprietor of the Elms Hotel, for their untiring efforts to make our stay at this place exceedingly pleasant.

"*Resolved,* That this Society hereby extends its thanks also to the Maine Central, Portland & Rumford Falls and the Bridgton & Saco Railroads for reduced rates."

The judges at the Annual Meeting were as follows: Prof. Samuel T. Maynard, on collections; S. G. Shurtleff, on single plates of fruit; Mr. and Mrs. John W. True, on canned fruits, etc.

Following the report presented by Dr. Geo. M. Twitchell relating to national legislation to secure uniform sorting, grading and packing of our fruit, it was

"*Resolved,* That this Society recognizing the importance of the proposed measures looking to legislation which will insure more uniform sorting, grading and packing of our fruit crops, and the work of the special committee appointed last year, hereby declares in favor of continuing said committee another year, in the hope that national legislation may be made certain."

The report of the Committee on Fruit Packages, made by E. L. Lincoln, chairman, was followed by discussion and it was

Voted, That the box matter be laid on the table.

ANNUAL BUSINESS MEETING.

The Treasurer, Secretary and Executive Committee presented informal reports and they were accepted.

After the appointment of C. A. Arnold, E. L. White and W. O Breed, a committee to distribute, collect and count ballots, the following officers were elected for 1907:

President—Z. A. Gilbert, North Greene.

Vice Presidents—D. P. True, Leeds Center; Edward L. White, Bowdoinham.

Secretary—D. H. Knowlton, Farmington.

Treasurer—E. L. Lincoln, Wayne.

Member of Executive Committee for three years—Charles E. Wheeler, Chesterville.

Voted, That the auditing of the accounts be left to the Executive Committee.

Trustees—Androscoggin county, A. C. Day, Turner Center; Aroostook county, Edward Tarr, Mapleton; Cumberland county, John W. True, New Gloucester; Franklin county, E.

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Maine Rolfe
By courtesy of N. E. Homestead

E. Hardy, Farmington; Hancock county, Chas. G. Atkins, Bucksport; Kennebec county, E. R. Mayo, Hallowell; Knox county, Alonzo Butler, Union; Lincoln county, H. J. A. Simmons, Waldoboro; Oxford county, F. H. Morse, Waterford; Penobscot county, W. M. Munson, Orono; Piscataquis county, C. C. Dunham, Foxcroft; Sagadahoc county, ———; Somerset county, Frank E Nowell, Fairfield; Waldo county, Fred Atwood, Winterport; Washington county, D. W. Campbell, Cherryfield; York county, J. Merrill Lord, Kezar Falls.

Member of Experiment Station Council—Charles S. Pope, Manchester.

Voted, That a committee be appointed to co-operate with other committees appointed by the Dairymen's and other kindred associations, to appear before the Legislature to urge upon them an appropriation of money to purchase a farm for the use of the Experiment Station in carrying on further experimental work in connection with the fruit industry.

Voted, That this matter be placed in the hands of the Executive Committee to present to the Legislature.

At the closing session Mr. W. O. Breed in behalf of the people of Harrison expressed the deep pleasure they had enjoyed by this visit of the Pomological Society to their town, and he wished to thank the Society for coming.

PAPERS, ADDRESSES AND DISCUSSIONS OFFERED AT VARIOUS MEETINGS OF THE SOCIETY.

ADDRESS OF WELCOME.

By Alphonso Moulton of Harrison, Master of Lakeside Grange.

In a larger and more pretentious town than Harrison the chances are that a Board of Trade would be the organization that would take the lead in extending a welcome to you, and the one selected for the task would doubtless be a man of note instead of a humble farmer like myself, whose proudest position is that of Master of our local Grange. In Lakeside Grange we have an organization which we think is even better than a Board of Trade. To be sure it represents those whom some have been pleased to designate as the "lower and laboring classes," but we well know that these classes are the ones who make the foundation for the whole structure, and that you are proud to number yourselves among them.

In this Grange we have an organization whose principal object is the elevation of the whole community, and especially of the agricultural portion of it. It is ever on the alert for what will benefit this part of our inhabitants, and through them, all of the residents in this vicinity. It was largely through the efforts of this Grange that this meeting was secured for Harrison, and it was wholly by its work that this elegant and commodious place of meeting was erected, an enterprise which few believed that we were capable of carrying to successful completion, and which has provided this village with a building which supplies a long-felt want, and of which it is justly proud.

It is meet and proper that this organization, the leading one in point of numbers and influence, and representing, as it does, the agricultural portion of the community, should be the one to welcome you to the hospitalities of the good town of Harrison, and I am not unmindful of the honor that was conferred upon me when I was selected as the one to give voice to that welcome.

Harrison, though it cannot claim to be a large town, is by no means the backwoods, out-of-the-way, and insignificant place

that some seem to suppose it to be. Though small in size, and with a population of less than 1000, its farms are numerous and productive, its farmers are prosperous, and in fruit-growing it is one of the leading towns of the county, having within its borders two of the most noted and productive fruit farms of the State, and several others whose average product goes up into the hundreds of barrels. It has several manufactories, which, though making no great pretense, are doing a more flourishing business than some other more pretentious concerns, and I trust that you will take occasion to look them over before your stay is completed. I assure you that you will find that visitors from outside are welcome, and that the proprietors will be ready to show you what they are doing.

You have doubtless discovered that Harrison is not a very difficult town to reach, and, if you could have made your visit in midsummer, you would have found our transportation still better. We are at the terminus of a railroad, which, though it is at present of the narrow gauge pattern, is in the hands of an enterprising corporation, which gives us three trains per day each way during nearly the whole of the year, and sees to it that the officials are always gentlemanly and obliging. We are also at the terminus of the famous "Sebago Lake Route," one of the most beautiful and attractive waterways in the whole country, a portion of the route being the celebrated Songo River, of which the poet Longfellow wrote:

"Walled with woods or sandy shelf,
Ever doubling on itself,
Flows the stream so still and slow
That it hardly seems to flow.

Never errant knight of old,
Lost in woodland or on wold,
Such a winding path pursued
Through the sylvan solitude."

It is a route over which thousands of delighted passengers travel each year.

Lakeside Grange represents the larger part of Harrison and the contiguous territory in Bridgton, and we are somewhat proud of our place of residence. Harrison and North Bridgton are two villages but a little more than a mile apart, each served in the same way, and with interests that are very nearly iden-

tical. From Harrison run four R. F. D. mail routes, covering the whole of this town, and quite a portion of the adjoining ones, and bringing daily to our doors the mails which we formerly thought ourselves fortunate to get once or twice per week by driving several miles after them. The telephone has been extended into nearly all of the surrounding territory, not only placing us in immediate contact with the inhabitants of this and neighboring towns, but making communication with people in distant places quick and easy. Truly we are so situated that we feel quite well satisfied, and not inclined to exchange places with those who may think that they are in a better town than this; but still we are not entirely content, and wish for two things more: Those are the widening out of our narrow-gauge railroad, and the introduction of the trolley car into our midst. When these shall come, as we expect they will in the not far distant future, we see no reason why there should be any more desirable place of residence in the whole State.

We are not unmindful of the honor which your Society has bestowed upon us in selecting this place for your Annual Meeting and Exhibition, and we are most certainly proud of having you with us, and of having your beautiful and extensive exhibition spread in the hall beneath us. We are well aware that your Society has been of immense benefit to the fruit growers of this State; that through its efforts they have been incited to new and increased exertions, that many improved varieties have been introduced, and that better and more productive methods of cultivation have been brought to light. Fruit growing is such an important industry in this State that whatever benefits those engaged in it, must benefit the whole State.

It seems impossible for such an exhibition as you have here, to be given, and for such meetings as you have arranged for, to be holden, without being of great benefit to those who attend; therefore we feel that they will be of great profit to us if we take the advantage of them that we should. You have done your full duty in the matter, and it lies with us to avail ourselves of the feast of good things which you have provided.

Members of the Pomological Society: In behalf of Lakeside Grange, and of the citizens of this and adjoining towns, I extend to you a cordial and sincere welcome. We know that you will benefit us, and we hope and trust that your exhibition may be so

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A view of Annual Exhibition, Harrison
By courtesy of editorial representative of N. E. Homestead

successful, and that the attendance and interest at the meetings which you are to hold may be so satisfactory, that you will have no reason to regret that you decided to make our little town your place of meeting in 1906. You who have come within the gates of the Grange are well aware that one of its leading mottoes is: "Whatever we do, let us strive to do well." I think that I am safe in saying that this is a principle that our town usually follows, and I trust that in our treatment of you, pomologists of Maine, we may be able to demonstrate the truth of this statement.

RESPONSE TO ADDRESS OF WELCOME.

By Charles E. Wheeler, of Chesterville.

In behalf of the officers and members of the Maine State Pomological Society, it gives me great pleasure to accept this cordial welcome. This grand organization of which you are a part is ever in the front ranks, for the up-building of society. No organization in this State has done more to take the home life upon the farm from out the ruts of drudgery. Meeting as you do each week or fortnight in your subordinate homes, there to discuss every phase of farm and home life, you not only create within each brother or sister, a desire to be more of a man or woman, but it extends to those of a younger age, and they come upon the stage of life better fitted to make the man or woman of the twentieth century ideal.

We convene here on this occasion to hold our 33d annual session.

The years of the past stand as a matter of history and, step by step, year by year, we have been gathering up the results of actual work along the lines of Pomology and a truer citizenship. Sifting out and separating from that experience which may to the fruit grower be either failure or success.

If this society had no object to attain but the word success measured from a financial standpoint, I fear it would fall far short of the intent of its founders, so, day by day, we go on hand in hand with you working for that success.

This society for all these years of work has had an object ever in view and that is, to point out and lead each and every fruit grower of this good State of ours to surer success.

This most cordial welcome given to us by your worthy master is reflected from each and every face, the hearty shake of the hand, the personal welcome, causes us to feel honored as your guests. The renewal of friendships and the formation of new ones will, we all know mark this "mile stone" of our society as one long to be remembered.

ANNUAL ADDRESS.

By Hon. Z. A. Gilbert, North Greene, President of Maine State Pomological Society.

The Maine State Pomological Society was formally and legally organized the 27th day of March, 1873, under an Act of Incorporation passed by the Legislature then just adjourned. Influential members of the State Board of Agriculture, prior to this, had discussed the propriety of organizing such a society. At a meeting of the Board, held at Skowhegan in October, 1872, previous notice having been given, the subject was taken up for consideration, but the records of that meeting show that, "owing to a small attendance, it was thought best, after discussion, to leave the subject in the hands of a committee," and Messrs. Z. A. Gilbert of Greene, J. A. Varney of Vassalboro and A. L. Simpson of Bangor were made that committee.

Prior to the next meeting of the Board of Agriculture, that committee issued an address to the fruit growers of Maine, inviting them to meet in convention with the Board at a session to be held at Winthrop, January 14-17, 1873. In accordance with the call there were a large number of fruit growers present, representing all parts of the State. After due consideration it was unanimously voted: "That it is expedient to establish such a Society." A committee was therefore appointed to report a plan of organization and nominate a list of temporary officers.

Another committee was appointed to procure an Act of Incorporation from the Legislature then in session.

In accordance with these preliminaries, the corporators of the Society met at Augusta on the date before named and launched this Society into its field of usefulness.

The first officers of the Society were: President, Z. A. Gilbert, Greene; Vice-Presidents, Geo. W. Woodman, Portland, and

A. L. Simpson, Bangor; Secretary, Geo. B. Sawyer, Wiscasset, and Treasurer, Chas. S. Pope, Manchester.

The act of incorporation gave us the sum of $500 annually, but stipulated that a sum not less than that paid by the State should be paid out in premiums. Thus the officers were at once up against the problem of carrying on the work placed in their hands and at the same time paying out all guaranteed funds in premiums. At the first exhibition held at Bangor the records show that $516 was awarded in prizes and was paid in full. Later on, however, the State aid was increased to $1000 annually, where it still remains. This enables us, by exercising strict economy, to carry on the work of the Society in the manner all members are familiar with at the present time.

I have been led to this bit of reminiscence by looking over the names of those noble men, interested in fruit growing, who associated in the early work of this Society. In that list there are but three left to participate in their chosen work at the present time. Were this the place, and now the time, it would be a pleasure to recall the lasting aid given to the cause we here represent by those intelligent, broad-minded and unselfish men. Verily the young men of today have a responsibility resting upon their shoulders if they fill the vacancies left by those who have dropped out of our ranks in the passing years.

Fruit production as a business at the time of the organization of this Society had reached comparatively little commercial importance. The shipment of apples to foreign countries had but barely commenced. Our Maine apples were dependent on the local markets and the Boston demand. From the limited production at that time, but thirty-three years ago, to the million and a half barrels of market apples in a single season is an increase creditable to the State. Just how much of this increase may rightfully be credited to the influence of this Society cannot be stated, nor, as connected with our present work, does it in any sense matter. This Society, according to the light in its possession, has held steadfastly to its mission, at all times putting forth its efforts in aid of the industry in its charge to the full extent of the means within its reach. That its course has met the approval of those for whose interests it has labored we have abundant evidence in the cordial support we have been and still are receiving, and I trust that the interest manifested in

the exhibition drawn out at this time, and in the exercises of this convention, will be a confirmation of a continuance of the same good will.

The pomology of the State has had a valuable ally in the Experiment Station connected with the University of Maine at Orono. Early in its work the Station recognized the importance to the State of our fruit industry, and at once entered upon experimental work in its behalf. This has been continued, according to the means apportioned to its use for the purpose, as the bulletins of the Station have shown, up to the present time. It would have been of interest to have shown the money outlay made from year to year by the Station, and also by the University in its support of the chair of Horticulture, but I was informed by the officers in charge that the complication of expenditures was such as to render their separation into distinct classes impracticable. That greatly enlarged work along horticultural lines in our State is needed every one familiar with present conditions is well aware. It is known that by a recent act of Congress the Government aid in support of the Experiment Stations was substantially increased. In view of enlarged working funds fruit growers would seem to be justified in looking for increased work in behalf of the fruit industry.

That the growing of fruit, especially of apples, is found eminently profitable there is abundant evidence among our successful growers. Our Society for some years has been urging more attention to the culture and the care of orchards that increased profits might be realized. That this teaching has met a widespread response among growers of fruit the large increase in the number of orchards under cultivation and the increased bounty of the bearing trees in all parts of the State give encouraging testimony that the efforts of the Society are meeting an encouraging response. In this direction, however, a serious obstacle stands in the way. Very few of our Maine apple producers make their orchards a leading feature of their farm operations. The orchard is a sort of side attachment to the general farming. In far too many cases, if not a general rule, the orchard gets only the time, attention and care that happens to be left after the general farming has been attended to. So it is that the orchard is so generally neglected and its possibilities so rarely realized. When our fruit growers make

the orchard the leading feature of the farm, and give first attention to what the teaching of this Society and their own experience and observation have shown them is necessary to an abundant and reliable fruitage, then will they begin to realize the full measure of the profits of an orchard. That progress is surely being made along these lines may be accepted in evidence that the faithful labors of the members of this Society, freely rendered, have met with their merited reward, and should be taken as an encouragement to continued effort.

The brown-tail moth and the gypsy moth situation is not very different from what it was a year ago. It was my privilege to accompany Dr. Howard, Entomologist of the Department of Agriculture, Washington, and Dr. Kirkland, in charge of the gypsy moth appropriation in Massachusetts, on the occasion of their visit to this State inquiring into the situation here. Strong suspicion was felt by these authorities that the gypsy moth may have been transported into our State along the line of travel from Massachusetts and New Hampshire, and it was stated by Dr. Howard that experts would be furnished to make a thorough search, after the leaves of the trees had fallen, along the line of probable approach. A rumor has been abroad that this damaging moth had made a lodgment on our side of the State line. The State Entomologist will give our meeting information in regard to impending dangers from these insect enemies during the course of our proceedings. Without question it is the sentiment of every fruit grower among us that the aid of the State should be continued in staying the progress of these insect enemies, and that action should be taken at this meeting providing for the further aid of this Society in bringing this important matter before the forthcoming Legislature.

Before leaving this matter I wish in behalf of this Society to commend the prompt and efficient action of our State Commissioner of Agriculture in the invasion of the brown-tail moth so suddenly thrust upon us, and with him the several individuals and municipalities that have so promptly tendered their aid in defense against its damaging progress in our State. Your President has strong faith that our important fruit-growing industry is not destined to be seriously decimated by an insignificant insect, but that intelligent action will sooner or later discover a way through which its damaging presence can be overcome.

Meanwhile we must be active and spare no expense in disputing its advances till other aid shall come to the assistance of the situation.

Secretary D. H. Knowlton: There are one or two matters to which I would like to call your attention at this time because there may not be so favorable an opportunity to do it later, and I do it with the hope that those of you who are present may bear the fact in mind and extend the notice so far as it may seem of interest and importance to you.

The first which I have on my memorandum here, without any reference to importance, is a box of apples below on exhibition which we procured from New York for the purpose of showing, first the quality, and second the style of packing, of fruit of which we hear so much at the present time. We know also that the noise they are making about it is particularly significant to us. I want to read you a few lines from the gentleman to whom we are indebted for that box of apples, Mr. Collingwood of the Rural New Yorker. These apples are from the Hood River Valley, Oregon. They are medium grade fruit and cost $3.25. Aside from the style of packing, what they sell for is a matter of importance to us. I will guarantee that those apples are not so good in quality as lots of apples on the tables below that were grown right here in the town of Harrison, but I want you all to examine them and see what style in packing means. This letter says, "I thought it might be better to get them than extra fancy which are selling for $3.75." These that we have, represent, as he expresses it "the rank and file of the crop" of the Hood River Valley.

I want to call your attention also to this collection of insects over here on the table, made by Miss Bernice Watson, of the Gardiner High Shool, who is here to offer any words of interest which she may regarding these insects. I was delighted this morning to see so many of the school children present, and I hope if there are any in town who have not had the opportunity of seeing them that they may come out.

I wish to call your attention also to a little package, I don't know what to call it, which a gentleman brought in to me from the town of New Vineyard—Dr. E. P. Turner. He has a large orchard which has been recently set in the town of New Vineyard on the home farm which he owns there. Well, last winter

and previous to last winter, his orchards have suffered a good deal of injury from the work of mice and he has been scratching his head, and raising cats and everything else to find ways and means of holding those mice in check. Well, as one result of that he brought into my office not a great while ago a little box—turned wooden box—which he worked up as being suitable for the purpose, in which he has very neatly packed a preparation of Paris green and Indian meal. There is a hole in the bottom of the box, very neatly covered with a little coating of mutton tallow. Now he says that the mice can't resist the temptation to eat mutton tallow if it is round where they can get at it. More than that, he says the odor of it is such that it will attract them to it from some distance. He says that a mouse hasn't got to do but very little work on that in order to get a full dose of the poison. It will be on exhibition so that you can see it and examine it and Dr. Turner himself will be here to answer any questions you may wish to ask him concerning it.

GREETINGS FROM OTHER SOCIETIES.

Prof. Maynard of Northboro, Secretary of the Massachusetts Fruit Growers' Association:—

It gives me great pleasure to bring greetings from the Massachusetts Fruit Growers' Association. Massachusetts is especially favored in having a large number of horticultural societies. We have perhaps the most wealthy horticultural society in the country, the Massachusetts State Horticultural Society, and also another society very prominent and wealthy, the Worcester County Horticultural Society.

The Massachusetts Fruit Growers' Association was organized some fifteen years ago by the working horticulturists. We have no home—we move about wherever we are invited—but we have an annual meeting at Worcester, the second Wednesday and Tuesday of March, to which we should be glad to welcome any members of the Maine Pomological Society or any friends of the interests of horticulture.

Our interests in Massachusetts probably are not unlike those in Maine. The condition of fruit growing today is very unsat-

isfactory, especially the growth of the apple, on account of the large number of insects and the difficulty in obtaining markets—of selling our products. Yet I think that difficulty would be overcome very largely if we could grow better fruit. I think that is the one point which we must work for. Good fruit always sells at good prices, and the more good fruit put upon the market the greater will be the demand, the larger the consumption.

Our difficulties are largely from insect pests. We can control the fungous pests, the blight, the scab, but the insect pests we are not able to control except at a great expense. With the older insects you are familiar, and the problem with you is probably the same as with us, how to get rid of the codling moth, the apple maggot, the caterpillars that feed upon the foliage. And we have now the gipsy moth and the brown-tail, and also the San Jose scale which is becoming a great pest, and with each individual it becomes the question of reducing the number and preventing the newer ones doing injury. The first brown-tail that you find should be destroyed. The individual should do what he can. The State should do as much as possible. I do not believe in treating the individual grower as a criminal because the San Jose scale, because the gipsy moth or the brown-tail, happens to be located on his property, but he should do what is possible, what is reasonable. The State should do the rest. And that is what is being done in Massachusetts. If you find the San Jose scale upon one tree, either prepare to destroy it—as can be done—or destroy the tree. That is the safest thing.

Prof. MAXWELL J. DORSEY: It is a pleasure indeed for me to be with you today and extend you greetings from the University of Maine.

I don't know of anything better than for men engaged in horticulture to get together and compare varieties, compare ideas, rub up against each other and compete in just such a meeting as this. I only wish that every man in the State interested in growing fruit could have the advantage that is before us here today of seeing these varieties, seeing this exhibit, and getting what we are geting out of it.

In this work the University and the Experiment Station wish to join hands. The Experiment Station can probably reach

your problems better than the University. It is the aim of the University to reach your problems through the boys and girls in this State, and it is a pleasure to me to meet with you here today and meet some men who have friends or perhaps sons in the University. I wish there were more of them. I think the University of Maine ought to hold the same position in relation to the farmers of this State that the University of Illinois or Iowa or Ohio or Michigan or some of those other universities do to the people of those states. And if you will help us out I think we can make the University hold this same relation.

Mr. CHARLES E. WHEELER: Last winter I went to Hartford, Connecticut, on a trip and it proved to be at the time of the last annual meeting of the Connecticut Pomological Society; and I can assure you I appreciated the privilege of attending that meeting. I appreciated also the things that I saw there, and I tried to bring home with me some things that might be of help to me, and it may be I will make some suggestions to you from things that I gathered up there during those few days.

In the first place, when I went there to that meeting, I found that it was a large hall like the City Hall of Portland. By ten o'clock the first forenoon, the main body of that house was packed and almost every individual had on one of these badges of membership—six or seven hundred of them— and they had paid their dollar. Wouldn't that be a help to us? I think it would.

Of course the display of fruit was far different than we find here at our meeting—they hold their exhibition in the fall—although there was a good exhibit in the hall below. And with that was one of the points that I wish to make here today. There was an exhibition of all the tools, or many of the tools that an orchardist would use in his business. It was a good display. There was a chance to go and see the working of those machines, as well as you could on floor space, and I know that orders were given and matters were talked over. Wouldn't it be an advantage to us to see some spraying apparatus in some hall, or other implements that we need? Well, there were basket manufacturers and others there, the tree-grower was there—the nurseryman, with full display of trees, and lots of other things that would come naturally with those things.

Now it seems to me that it would be well for our officers in years to come to provide for these things, to invite manufacturers to exhibit, that we might see those things.

Prof. ALFRED G. GULLEY: I belong to the Connecticut State Pomological Society. That is a wide awake society. I am, however, a representative of a Connecticut State Agricultural College which is located at Storrs. I have a little state over there that is doing something now in horticulture, or more strictly one branch of it, pomology, which is now covered quite ably. But it has wholly come up in the last twelve or fourteen years, wholly because some men there wanted to do something. Now we have got a State Horticultural Society that is forty years old, more or less, twice that for anything I know—and they have not done a thing in twenty years practically. They make a little show every year, a few of the members take all the prizes, and that is all there is of it. We have a good deal better working society in pomology which I think has been doing some good for the last ten or twelve years—at least it has changed our products in two or three lines from practically nothing up to a pretty large amount. We are interested in one or two lines you don't touch. The peach growing is a pretty big thing. It represents a pile of money this year to some of the growers there. It represented a good deal last year. Over five millions of trees were planted this last spring in peaches alone. So that we are doing something in that. It is uncertain even in Connecticut, from our climate—that is the worst of it.

We hold a regular annual meeting in February. We hold an annual exhibition in September, about the 25th. This is always held now in connection with one of the local fairs—whichever fair wants us the worst, will pay the most—we go. That is all the way we locate it—with the understanding they will give us all the privileges we ask for, and they do now, and mighty glad to have us come. Our little show this last fall covered about twelve hundred plates; we have had up to sixteen hundred. We do have an annual show at our annual meeting of one, two or three hundred plates as the case may be, and somewhat of machinery, of which Mr. Wheeler spoke. That is certainly valuable. I have been working hard five years to get it into our meetings as much as possible. It has required a deal of work to get the blamed manufacturers to bring it. It is a little too far for them, and they have got all they can attend to at home.

Mr. CRAIG, of Auburn: It affords me great pleasure to present to you in the first place greetings from the first, you might

say the pioneer fruit growing society in Quebec, that is the local society where I was born and brought up—Abbotsford Fruit Growers' Association—of which I have always been a member. This little local society was organized when I was in my boyhood, and has always done efficient work up to the present time. It was one of the first in getting a grant from the Government and holding a little local exhibition and working up the fruit lists and getting them in satisfactory condition. At the present time its usefulness is about at an end because it has fulfilled the mission it was first intended for, that is, to get the fruit lists and fruit into shape and to know what we have. Now the general feeling is we want to spread out and compete with the outside world more. Steps are being taken at the present time to amalgamate all these little local exhibitions in the Province of Quebec and to have a provincial exhibition.

Secondly, I would just bring you greetings from the Quebec Pomological Society and Fruit Growing Ass'n. That has been in existence some sixteen years and I happen to be a charter member. That association is very much like yours here. We hold a summer meeting and a winter meeting. It also has done very efficient work. It was practically at the bottom of all these late innovations in the way of fruit inspection and Fruit Marks Act, and other advantages which I consider we have over Maine at the present time. And this Association is a little bit dissatisfied now and we are taking steps at the present time to have this a Dominion Fruit Growers' Association, so that all the different parts of the Dominion of Canada will meet in a winter meeting like this and show their fruit and be able to compare it and to know what other people are doing. The work will thus no doubt be to the great advantage and benefit of the fruit growers.

HOW CAN THE MEETINGS AND EXHIBITS OF THE SOCIETY BE MADE OF THE GREATEST EDUCATIONAL VALUE?

Mr. Edward L. White of Bowdoinham: Now I don't like to have this question confined to the meetings alone. We only meet here for perhaps two or three days and that closes our meeting for the year. I think that the question should read "How can it be carried into the State to be made of the most educational worth.

Now I have only outlined a few of the questions— one or two of them are old questions perhaps—one or two of them are questions that would come before the young fruit grower. We have very often heard how to set out an orchard. We come here once in a while and hear of setting fillers, that is, setting a row of what we want to set—perhaps the Sutton or Baldwin, and perhaps fillers of Wealthy or such trees as that between and cut the Wealthies out. This is a question that has come up in my locality a good deal. The question arises, does the orchardist cut out those Wealthies when they come into bearing, or does he let them stay there and spoil the orchard? This is a question that would be of great benefit to me to take back to my people and decide for them—that is, to tell them what the opinion of the State is in regard to that subject.

And the conditions of soil for the different varieties. One or two years ago we had a speaker in regard to the altitudes of the different varieties. In some sections the Wealthy will grow in such a way that they will keep until February or March. Now that is a question, perhaps, that should come before the orchardists in this State, the conditions of the soil for different varieties. And then the varieties of fruit, their adaptability to certain sections of the State. My folks at home have had occasion to visit Aroostook County and to see the Dudley Winter growing there. We bring it down here with us and it does not keep as long as in Aroostook. So that proves that the Dudley Winter is an Aroostook apple, adapted to that locality. Now this is a question that confronts us a good deal in our section. The variety of course, I will acknowledge, is a good deal in the

taste of the grower. It is just like poultry, some people like the Barred Plymouth Rock, some the White Wyandotte. These are questions I think that we should discuss more or less.

Another point I wish to touch upon more or less is the judging of fruit in our local fairs,—county fairs and town fairs. We look around in the State and see the different organizations, the Dairymen's Association, the Poultrymen's Association, and the different organizations. A few years ago in our Legislature at Augusta they passed a law that the stock in our fairs should be judged by a certain standard; and you go into our Poultry Associations and they have a standard to go by. In my county, Sagadahoc Agricultural and Horticultural Society, they have a standard of their own, and one or two of the adjacent towns, they have a standard of their own. Now when I go to a fair and look at fruit, I like to see fruit from a well pruned tree, and fruit with no scab on it, no worm holes in it, get the prize. When there is other fruit of equally the same size and perhaps equally the same in color, but with one or two wormholes, I don't like to see that get the prize. A short time ago in one of our fairs, a line of Wealthies was run up and down where they tiered the apples and the passers-by were looking around there and two or three happened to stop just as I did, and they looked up to the top row, and there was a plate of Alexanders with first prize on it. We thought that must be a plate of Alexanders with first prize. We took the card off of that first plate and found it was marked first prize for the Wealthy—an Alexander taking a Wealthy prize! Now if I breed the Holstein cattle and I go and compete against the Jersey man for beef, the Jersey man don't stand any show at all for size in beef. If I go to these fairs and compete a Wealthy apple against an Alexander apple, I might as well stay at home. I don't learn anything. And so I feel our Pomological Society should in some way mark out a standard.

This forenoon, in reply to the address of welcome, our Bro. Wheeler made the point that the Pomological Society was endeavoring to make better citizens of our farmers. Now it is sometimes the fact that the farmers do not care to market their fruit the right way perhaps, and sometimes they don't care to put it in the right package that will demand the most in the market, and I think it is the duty of every man, as a citizen of

the State, to watch our Legislature work. We have to go to them sometimes when we do not like to. If we as horticultural societies all over the land could join together and decide upon one box, and decide upon the way of packing and things like that, why we should not have to go to the Legislatures of the different States or to our National Congress. But that is not the case now. The farmers do not care to join together that way. In Canada—Bro. Craig has just spoken for them—they have the Fruit Marks Act. Now I do not believe he thinks that the Canadian fruit is better than the Maine fruit. But it sells higher in the London markets. So I think it is a duty upon every citizen to watch our Legislatures, watch and see what the men are doing there, and in some way get in touch with them. They are willing to hear from us and many times are willing to grant our petitions. Now there is another way of doing this thing—if the Pomological Society could in some way come in contact with our Granges all over the State, and have them discuss the Pomological subjects, and have them join hands with us in the legislative work, I think it would be of great benefit. And let the Pomological Society have one point before all the citizens,—that a farm with its dairy, and a farm with its poultry, and a farm with its swine, is not complete unless we have a well-trimmed and a well-cultivated orchard of well colored fruit on it.

John W. True, of New Gloucester: The officers have prepared annually a premium list and a program, and they have used all the intelligence they have, I know, to give us an educational exhibit and educational meetings, and for me to suggest things for them to give us in addition, it seems to me is, well—something that I cannot do; because, as he has said, they had when they commenced $500 from the State—the rest has come from private individuals. That $500 was to be given in premiums and all the expenses were to be footed by the individuals. Then it was increased to $1000, and since that increase to $1000 the fruit industry, I am quite sure, has more than doubled in this State. Just think of the importance of this fruit industry to this State today and compare it with what it was in 1873. Why, you can hardly imagine the strides that it has made and that it is making every year. Now one of the first things, it seems to me, that it is necessary for us to do is to ask for more

money from the State to spread this education, to make it more educational. Because I feel that our officers have done all in their power with the money at their command to make it what it should be.

Now there are just a few little points that perhaps we might change that I have thought of, and one of them is this: We are all the time looking for something better. That is what makes life worth living. We are hoping to find an apple that is a little better than the Baldwin in all respects. Now if we had the money it seems to me that we could profitably offer a fairly liberal premium for seedlings to be exhibited on a table set apart by itself. That is the only way we are ever going to get anything of that kind. It would not take a great deal of money—might divide it into four premiums, perhaps, and the man should be obliged, when that premium was awarded, to give a description of the tree and its history so far as he could, and it should be made a record. We know that almost every man that has an old orchard, had what we call natural fruit, very few grafted apples. But when he found one that was particularly good it was scattered through the neighborhood, perhaps, but there it ended—many of them ended there. I have an old farm that has trees that—well, fifty years ago they were just as large as they are now apparently, but they show marks of grafting, and that has one of the best cooking apples that we have. But it never has been disseminated, so far as I know, beyond that one tree. But it seems to me that there would be a line that if we had a little more money could be profitably put in practice. I had intended to bring in a couple of samples of apples in here with me, but I forgot it. We have an experiment station at Orono that is for our use, for our benefit. They are able with the money that they have to put a man onto one job, we will say, and let him spend one, two or three years and work out something that will be of benefit to the whole State of Maine. We have a member of the Experiment Station Council. It seems to me that one of his duties might be to make a report to this meeting of what they are doing.

Now there is one other point that takes a little money again, and I am not sure but what the officers have looked into that this year a little. You come here to one of these meetings, and one of the first things that you will see is a man, or a lady,

going round with an apple in her hand and wanting to know what it is. Now lots of our trees come from New York and they don't come true to name always. They will buy a Baldwin, or a McIntosh Red or a Milding, and they will name it Milding, we will say, or whatever it is, and the name will not be correct. If we could have a man from New York come here to our meetings, I think he could help us out wonderfully on a great many kinds. Some people have a kind that if they knew what it was, and it was a valuable kind, a young tree just coming into bearing, they would like to keep it as it is; when if it was an apple of no particular consequence it would better be retopped. It seems to me there would be a chance of spending money well to help out the interest in our meetings. People would bring their apples for just that purpose. We have apples brought here now for a name but very few of us here know what those New York apples are, and lots and lots of people go home without having their apples named.

One other little point—I don't know whether it would help you out or not—but it seems to me it would—just a little point that the officers can make a rule to cover. It is to furnish plates of suitable size for the different apples, and the rule should be that they should all be exhibited flat. Have no piling of apples. The people that want to look these over don't care to pick them off the top to see what is underneath. And if they are laid flat it seems to me that the tables look very much better. It would be of more interest to the people that are looking them over and in every way the appearance would be better.

Mr. Charles S. Pope, of Manchester: There is one little point that I wish to speak of. I had the pleasure of accompanying the Farming Special this summer for a few days, and it has occurred to me that we might do something along the line of exhibiting that they did on that train, in the way first of tools,—the smaller tools particularly; then the trees, limbs and branches, etc., showing the different diseases, and also showing the different insects that are working upon them. That would give the people a chance to see how these insects are working and call for aid in remedies. Then they went so far as to carry the soils which are best suited for orcharding. It might help some people who are just beginning in the setting of trees, and you will find that there is something that must be said along

this line all the time. I had a letter a few days ago from a Portland party saying that men were coming here from New York and bringing experts with them to look up land to purchase for making investments in orcharding in Maine.

Our rules require that no insect shall be in any of the fruit which is exhibited; no wormy fruit can take a premium. This is to educate the people that we want to raise perfect apples. And in the matter of our speakers, we have aimed to send for experts as far as the money of the Society would allow, experts for speakers, who will show us where we could make our gains. And here is where I would agree with ex-President True, that a little more money is what we need, that we may send speakers for this Society all over the State. There are those who are all the time seeking for assistance, and we would be able in this way to send a speaker where he was needed.

Mr. ALONZO BUTLER of Union: I would suggest that we appoint a committee on nomenclature and entertainment, and make it the duty of this committee—some one of the members—to be on duty at all times to name fruits presented for name, or if this is not possible to send them away where they can be named, to New York or Washington; and also to act as a recruiting committee, to invite people to come into the meetings, to bring in their fruit and become members of the Society, and have a kind word for them and appreciate their presence. I would also suggest that there be no wall tables, but that the tables be arranged in a rectangular form, with a space inside for this committee, so that the strangers coming in may know where the location of this committee is, and that there may be no trouble in finding them at any time.

It seems to me that if five or seven were on this committee of nomenclature and entertainment that something could be done to increase the interest.

Secretary KNOWLTON: I am very glad indeed to hear our President call attention to the young men, and to the young ladies too. I have tried in what I have had to do with the Society, in making up the program, to get in just as many young men and young women on the program as possible, and it was with special pleasure that I invited the lady who represents this exhibition of insects here, a young woman just out of the high school, who is delighted to study these things, and

I say it with all respect to everything else that we have on the program, that the most instructive thing along nature lines, and along fruit growing lines, if you please, because the enemies are in there and the friends too, is right there in that collection—the insects, and what the young lady is telling these boys and girls and the older ones in regard to those insects. Now we are not doing enough of it—it bears upon me as well as upon others—but I trust that the future officers of the Society so far as the program is concerned will endeavor to get in more young men and more young women in this work.

And another thing, we are having failures in our fruit growing—failure in growing this variety, failure in growing another variety. failure perhaps in reaching the right markets and the like of that. Now I think these things should be made quite a conspicuous feature of our meetings. Let fruit growers tell their failures and others will be seen to profit by them.

We are not making our exhibitions as educational as they should be. First of all, it should be borne in mind that here in the State of Maine, the exhibition of the Maine State Pomological Society, is the type, so far as there is anything of that kind, of perfection in the State of Maine along that line, and you go round to the different agricultural fairs that are held in the State of Maine and they are trying to imitate us. Now some of those things it seems to me we are doing wrong. They should be improved, and it is up to us to make those improvements. But we are not making, at the same time, our exhibits as good as they ought to be. It is not the fault of the officers particularly, except that circumstances—I will call it circumstances—have prevented us from appointing some one in charge of these exhibitions along decorative lines and perfection lines, if you please, to make the exhibitions better and more attractive.

I should be glad if we could have an expert come every year, pay a man who knows how to make up a good exhibition; then let the officers of the Society do something else. It would help us wonderfully and it would make our exhibition an object of study and a pleasure to every one who comes here. We are having it a little better done this year than ever before because this year we have Mr. True to assist, and he in a very quiet way has been to work down stairs and straightened out a lot of things.

Sometimes the fruit entered is not properly placed and the judge cannot be expected to spend time hunting for the missing plates. He says "Well, I will pass on these," and he makes his mark on the judge's book, and that comes as the verdict of the Society. A man who has got a plate of the same kind over here in another part of the hall, comes to me and says, "What does this mean? Are not these better than those?" "I don't know."—I am not judging the exhibition. I always swear by what the judge does, whatever it is. At the same time I know in my judgment that the judge, while he has not made any mistake—the verdict of the Society goes out wrong—the man who has the overlooked fruit is mad with the Society and says he has been treated unjustly, and it is all because this kind of work I am speaking of has not been well done.

WHAT A TREE TOLD ME.

Dr. GEORGE M. TWITCHELL, Auburn.

I like,—yes, I love an apple tree. Somehow, getting out among the trees the last two or three years when I have been free from other cares and have had the opportunity—I found I had not been doing my duty by them.

I bought an orchard a few years ago and noticed limbs where the wood growth had been but one or two inches for the season. It seemed to me as I went among them that they whispered to me and said "I am hungry." So I opened up the soil and began to fertilize, applying bone and potash and stable manure. The next season I was surprised to see how they responded in woody growth and since have yielded good crops of fruit. Two years ago, going on the farm where I have been I found the same condition, and the trees seemed to me still more stubborn in insisting that they wanted something to eat. So I began experimenting; on one lot we put 14 lbs. of Fisher formula fertilizer per tree, applying it on the outer circle of the branches; on another we put a horse load of strawy horse dressing per tree and in another portion I fenced and introduced the hogs. That introduction paid, for the hogs opened the earth about the trees and fertilized in grand shape. It was a case of friendship from the first and the only thing for me to do was to see to it

that they did not get too intimate. Don't overstock if you put hogs in your orchard and be sure to glance over the trees daily. If any tree is receiving too much attention call the hogs away by scattering a little corn in some spot neglected.

Two years have told the story. That portion of the orchard occupied by the hogs has made great growth of fresh wood, given an abundance of rich, deep, strong leaves and best of all a large crop of fruit free from the railroad worm and practically so from other insect pests. Those trees where the horse manure was spread produced big crops but not free and smooth as where the hogs had cleaned up the apples that dropped, while those in grass, where the Fisher fertilizer was applied, gave only a moderate increase of fruit. Experience has satisfied me the quickest and cheapest way to free our orchards from wormy apples is by hogs or sheep, quickest because every affected apple that drops is eagerly eaten, and cheapest because the devouring of this infested fruit, and the fertilizing of the land, sure to follow, will radically improve the size, yield and quality of the fruit. Here the result of companionship may be seen and it was a valuable object lesson to me. The trouble is we set our trees and then expect them to go alone. For one I love the company of an apple tree, to get out in the twilight of summer evenings and talk to them as though they were human, to look them over as one would a friend, to watch and see if there's any injury being inflicted or any limbs broken, to enter into partnership for business and pleasure and get solid satisfaction watching conditions improve year by year. The closer the affinity between the man and the tree the more probable that the tree will get good treatment—right treatment, so that it can respond in fruit. I take it that the reason why we do not get more or better fruit from our trees is that we fail to appreciate the reciprocal relations which must exist for the best to be possible. Go among your trees frequently, talk to them earnestly, listen to the story they have to tell, learn their wants and supply their necessities and by so doing find profit and satisfaction. I pity the man who cannot find time or inclination to go among his trees and enter into close companionship, who thinks this nothing but fancy, a play of the imagination. Trees talk as well as breathe and their language is clean, sweet, helpful and inspiring to him who seeks to know their moods and answer their necessities.

There is no animal on the farm which will respond to an invitation like an apple tree, provided that invitation be intelligently written in a good clear hand. So if my trees want company in the future, they will have company. If they want something to eat, they will have something to eat. And we will solve very largely, I think, the question of spraying through fertilization. If we will give our orchards the food they need for the production of five, six, eight or ten barrels of apples so they can maintain their vitality and make the wood growth necessary for their future production, we will insure a quality of fruit and a power of resistance which we do not dream of today when our trees are starving for something to eat, and sending their roots out in every direction under the bound turf and around the rocks trying to find food which we fail to supply as we ought in order that they may give us the returns.

I have been having a good time by myself among the trees the past two years, and enjoying it—getting a measure of satisfaction that I cannot obtain in some other ways, finding a degree of inspiration from a touch with Mother Earth which does not come through things we can construct ourselves. There are mighty forces and agents at work in this world, and what you and I want, friends, whether growing apples or any other products, is to touch elbows with the Almighty in this work, with reverence and appreciation of what these agents and forces will do for us when we properly co-operate. When we feed and do for our trees as we would have them do for us, we get a response that can come in no other way.

BEST AND MOST PROFITABLE APPLES FOR PISCATAQUIS COUNTY.

WILL E. LELAND, East Sangerville.

It is only until within a few years that apples have been numerous enough in Piscataquis county to attract buyers. We have learned that the older orchards contain far too many varieties, making it necessary to take a smaller price for the fruit, even though the quality is good, than we could command if this were not the case. The question then of best and most profitable varieties to retain becomes one of great importance, and the elimination of the others a task which we should not neglect.

We have a large and growing market in northern Maine. One buyer shipped last season, from the B. & A. station at Dover over 1200 barrels into Aroostook county. The demand is for large apples of good quality. They will have no Ben Davis, neither do they want the Fameuse. It is not large enough for these hustling potato growers.

One of the most profitable varieties in our experience is the Rolfe, an apple that originated in Piscataquis county. At the present time it is too well known to need special description but a short sketch of its early history may be of interest. It is supposed to be a seedling from the Blue Pearmain. The nursery in which the seeds were planted was located in the town of Abbot on the farm of a man known as "Uncle Rolfe," who, when the trees were large enough for transplanting gave a dozen of them to the first settled minister in the town of Guilford. This minister, the Rev. Thomas Macomber, lived near that part of the town which is known at the present time as the "Centre." The twelve trees, it is said, nearly all produced food fruit but this one, which is known as the Rolfe, was so far superior to the others that when its fame became known it bothered the good elder and his wife to secure enough for their own use. The original tree being one of the first in the town of Guilford is now dead. As a variety it is very productive and hardy. Its choice quality and handsome appearance command the highest price. We received the present season 62 1-2c per barrel more than

for other varieties. The supply never equals the demand in Piscataquis county, and more trees should be set.

Another good variety is the Milding. This apple originated in Alton, N. H. The first scions set in Piscataquis county were in the orchard of H. L. Leland, who received them from brother Gilbert, the present president of this society. The tree is a vigorous, upright grower which in our snowy county is an important point to be considered. The fruit is large and usually good color when the trees are properly pruned. It must be sprayed to insure against loss by scab, and should be gathered early as it drops badly when allowed to fully ripen on the tree.

Among other good varieties in this section will be found Nodhead, Hubbardston, R. I. Greening and Northern Spy, all of which are too well known to need special mention.

In a letter published in the report of this society for the year 1885, that well-known fruit-grower, the late Calvin Chamberlain of Foxcroft said among other things concerning the Baldwin apple, "Large numbers of well-grown Baldwin trees were brought here from Massachusetts and other states many years ago and they very rarely lived to produce fruit. Some trees in the older orchards upon the hills have had their tops changed to Baldwins. I have done some of it myself and some of these still live, but yield a fruit that would be passed as inferior at Hallowell. I consider this variety to be estopped by climatic influences alone, at or a little below the 45 degrees of latitude." At the present time the Baldwins' sphere of usefulness has widened and is one of our most reliable varieties when grown on high, well drained land.

Large numbers of young Stark trees have been set within a few years which would seem to indicate that most people think this is to be a desirable and profitable variety.

Piscataquis orchardists in common with others are learning that cultivation or some other method of procedure which shall leave for the tree the fertility and moisture of the soil is absolutely necessary to the production of profitable crops.

A MASSACHUSETTS MAN ON A MAINE FARM.

W. O. Breed, Harrison: I have several times rehearsed in the presence of a large proportion of the audience that is now present, the reasons why I came to Maine, and something of what I have done on the farm on which I now live. I will not go through that again. But I will just mention a few of the conclusions and let it rest there.

One of these conclusions is that were I placed in exactly the same position that I was six years ago, I would do the same thing over again—I would come down into Maine, and I think I would come to Harrison. Another is that, as I said, I would do the same thing over again—I would buy a fruit farm—for the reason that I find that the easiest money that I can get out of a farm comes from my fruit orchard. Cows, sheeps, hens, are simply not in it at all. A small orchard on a farm is one end of it, a good fair-sized orchard is one end and the middle, but a big orchard is the whole thing. There is no money, as I said, which you can get out of a farm so easily as you can from your orchards, and it is a wonder to me that men living in this town and towns adjoining, with fairly good-sized orchards, do not take the care of them which they could just as well as not and double and treble their receipts.

Another conclusion is that you cannot possibly afford to grow grass in an orchard, my good friend and neighbor, Mr. Dawes, to the contrary, notwithstanding. The best apples which I have gotten within the last few years, the largest, fairest, and best in every way, have come from those sections of the orchard which have been the most thoroughly tilled by the hogs, from the soil that the hogs have rooted over and over again.

Another conclusion is that under no circumstances whatever will I from now on allow fallen apples to stay on the ground. I will have hogs enough in my orchard to keep them all picked up until it is about time to pick the apples, or I will pick them by hand; and if for any reason there are any apples left on the ground after picking from the trees, those will be picked up. And my reason for it is this: Three years ago I had hogs enough in my orchard so that they kept the ground clean, and I got clean apples the next year, or practically so. It was almost im-

possible to find codling moth holes or worm holes in the apples. As you looked through the trees the apples were practically free. The next year my quota of hogs was less. They didn't keep the ground clean. Last year I sold my hogs or pigs down still less, and there were more apples dropped on the ground. After picking the apples I put some boys into the orchards and set them to picking the fallen apples, the windfalls, and they picked up a lot of them and it got to the point where I said, I have got all the apples that my stock can take care of and it is costing me six cents a bushel to pick up the apples and I guess I will let the rest go. And that is where I failed. In that section of the orchard where the apples were left on the ground —and those windfalls were mostly windfalls from the action of the codling moth—I have picked from some of those trees this year nice large crops of apples, and about one in ten has been an apple clear of a codling moth. Nine out of ten, and in some cases ninety-nine out of a hundred were infested. Saving my six cents a bushel on picking up those apples cost me more than a dollar a bushel. I am not going to be guilty of that again.

Another conclusion is, as you may perhaps gather from what I have said, I am going to keep hogs enough in that section of my orchard that I cannot plow or harrow so they are going to keep the ground rooted over. I cannot afford to grow grass, but I can afford to pick fine, clean, large apples that are free from the codling moth, and sell them at the top notch.

If I had my life to live over again, I would dip into the growing of apples to the full limit; unless I had a family to, as the Irishman said, contend with—I would if I were alone by myself, I would live on crackers and milk—I can do it and did for a year and a half once to cure the dyspepsia, and I could do it again—I would live on crackers and milk and I would have a farm, and I would have another farm, just as fast as I could add one to the other, and set them out to apple trees, and keep them growing as they should grow, and if in twenty years or twenty-five years I wouldn't equal the Apple King of Maine it would be because Bro. Whittier had done more than he has already done. And this is a possibility with all young men. Why the young men of this State leave the State and go to the cities or other states and undertake to eke out a miserable existence—and it is more miserable than you think for sometimes according to their glow-

ing remarks as they come back to the old home—why they do this, and leave this grand chance at home, I fail to understand. It is within the reach of any young man in this audience to start in now and in twenty years from now have an income such as falls to not one in fifty that goes from the country to the city—and have an income and practically do nothing three-quarters of the year.

Mr. WILLIAM CRAIG, of Auburn: Why Not Grow More and Better Fruit in Maine?

I am presenting this question with the object of provoking a discussion which will likely give me the desired answer to my question, viz.: Why not grow more and better fruit in Maine?

In looking over this beautiful, undulating country I am more and more surprised to find so little attention given to fruit culture, and the thought would come into my mind so frequently with interrogation, Why is there not more fruit grown? This question only can be answered by the older residents.

In the favored fruit belts of the province of Quebec we are at a loss to find naturally drained land suitable for enlarging our orchards, whereas in Maine nearly all of the sections which I have visited are beautifully adapted, and again I ask, Why not cover those hills with fruit trees and increase the wealth and prosperity of the State?

For two years I have been causing a little disturbance in the soil by way of cultivating part of my scattered orchard in Auburn, and I assure you the results are very gratifying. In one instance six Rhode Island Greening trees occupying one-tenth of an acre, and having a very poor record as bearers, yielded this year sixteen barrels of salable fruit. Two years ago we broke up the soil, which was very thickly overgrown with witchgrass, and dressed and planted it to fodder corn. No apparent results followed, with the exception of an extra wood growth. This year we repeated the treatment and the trees responded with the above results. At this rate 160 barrels per acre would be realized. Supposing this fruit (which is yet unsold) is worth $2 per barrel, I will realize at the rate of $320 per acre in fruit alone.

If we examine the history of these trees we will find the secret of their bad behavior in years gone by. The land which they occupied had yielded hay for fourteen consecutive years, and

this is where most of the trouble lay. The hay crop will draw out all the available moisture, and what does the poor tree do? It does without. Thus the tree, being reduced to such a low state of vitality, has great difficulty in surviving our winters. The chances are it has not been pruned and the caterpillars are allowed to live and prosper, thereby depriving the tree of breathing power. If the tree shows a profusion of blossoms the shiftless fruit grower will likely have great expectations, but disappointment is more likely to result. The codling moth and railroad worm have full sway, and the fruit not being worth gathering is left on the ground to propagate more disease. We need not follow the history of the tree struggling for existence, and results in this kind of orcharding are easily predicted.

What is the cause of this neglect? I say it is lack of love and sympathy with the tree. Our blessed Lord inferred in his teachings that if we love him we will serve him. Cannot this rule be applied practically along horticultural lines? I have the greatest respect for any tree, but more particularly for a fruit tree, especially when fragrant with blossoms. That is heavenly. Who does not admire a heavily laden tree of beautiful fruit? I feel like taking off my hat and saying, May your shadow never grow less.

To succeed in any line of business we must like it, and so it is with orcharding. I must say that I am not in sympathy with the system of orcharding where everything is taken and nothing returned. It does not appeal to an up-to-date consistent orchardist. Furthermore, what is more practically and substantially beautiful than a seventy-five or one hundred acre commercial orchard! How many are there in Maine? Lastly, let me add, there is no better legacy to leave than a thrifty orchard of well selected varieties. Your children, while enjoying the kindly fruits of the earth grown on the beautiful hillsides of Maine, will surely rise up and call you blessed.

SORTING, PACKING AND GRADING FRUIT.

Dr. G. M. Twitchell, Auburn.

At the last annual session of this Maine State Pomological Society, the following resolution was given an unanimous passage:

"That this society, recognizing the substantial growth of our fruit industry and realizing the necessity for a more critical grading of the stock, for the protection of the grower, declares in favor of national legislation looking to a Fruit Marks Act, and authorizes the appointment of a committee whose duty it shall be to correspond with the officers of the Fruit Growers' Associations in the several states, and if a general sentiment is found favoring such action to arrange a conference for the purpose of outlining national legislation, said committee to be authorized to expend a sum not to exceed fifty dollars for postage and necessary printing and expenses, a full report to be made at the next annual session of this society."

In submitting a report of the work done the past year by your special committee on sorting, grading, packing and inspection of fruit intended for shipment, I regret that more has not been accomplished yet am certain that the agitation of the subject, set on foot by this society, is gradually leavening the lump, and, if we persist in our efforts, and are willing to wait patiently, we shall secure legislation which will be of incalculable service to our fruit interests. I am convinced that it would be unfortunate for that legislation to be hastened. Neither the growers nor packers are yet alive to the purpose or the effect of the measures proposed and the educative work must be continued for some time before we shall come to realize the immense loss resulting from present methods and certain profit sure to follow a system of inspection, grading and branding as thorough as that now applied to other food products.

Our plea for legislation must be along the same line as that presented in behalf of inspection of other products, even if the element of danger to health does not exist. Following the last session I sent to the officers of all pomological or combined societies in the East, Middle West and West a copy of the following circular letter:

MAINE FARMER PRESS, AUGUSTA

Packing-room—Miss Georgia V. Wilbur, Phillips

Dear Sir:

Realizing that by the failure to properly grade and mark our fruit shipments there is loss to the producer as well as shipper both in price and reputation, the members of the Maine State Pomological Society, during their late annual meeting at Canton, Nov. 14-16, appointed the undersigned a committee to confer with the officers of all known like organizations in the country, ascertain the situation in each State, whether it is desirable to unite for any national legislation governing the grading, marking and inspection of fruit for shipment, and also to arrange with others, if deemed best for our fruit interests, a meeting at some central place where the whole problem can be discussed and an intelligent decision reached. Will you kindly give me your opinion regarding the situation in your State, whether there is call for any consideration of this question and whether such a meeting as is here proposed would meet your approval? Canada by its Fruit Marks Act has materially raised the average grade of its shipments, Nova Scotia has, by this same act, regained her former reputation for quality, and buyers and growers alike attest its efficiency. The first question for us to consider is whether there is any call for improvement in the grading and marking of our fruit, and if so, how best to secure the desired end.

May I not be favored with an early reply and your candid opinion of the situation?

I firmly believe that united efforts can add greatly to the cash returns from orchard shipments and give our fruit a more permanent position in all the great markets of the world.

Awaiting your favor,

Very truly,

GEO. M. TWITCHELL,

For Maine State Pomological Society.

The replies came promptly in most cases, and in several the interest manifested was so great that I was at once urged to visit different states in the West and discuss the questions at fruit gatherings and institutes. New Hampshire is, I believe, the only state from which I have no reply. Let me present a few of the many letters received:

From James Handly, Secretary of Mississippi Valley Apple Growers' Association, Quincy, Ills.

Your esteemed favor was received some weeks ago and I was very much interested in its contents. As I am editor of the Apple Specialist, I availed myself of the opportunity of publishing your letter in the January issue of the paper. I hope that this publicity will do you some good, that it will bring a union of effort among fruit growers all over the country, that will be very beneficial in results.

I wish to say further, that I am on the program to make a talk on marketing fruit at the annual meeting of the Wisconsin State Horticultural Society which will be held at Madison next week. I am so much interested in your letter, and what it suggests, that I will read the letter before that meeting. I shall hope to hear from you again on this matter and will be very glad to keep in close communication with you all the time.

From C. W. Smith, Secretary of Rhode Island Horticultural Society, Providence, R I.

I received your communication in reference to grading fruit some time ago, and at our last meeting January 17th I had it read. Owing to a press of other business the matter was referred to the President and myself to report at our meeting in February.

So far as our state is concerned we hardly cut a sufficient figure in the fruit business, especially as shippers, to give a clear answer to your question. There are but very few large orchards in the state and I believe our home market absorbs all their products.

My attention has more recently been called to the necessity of a proper grading of fruit, and we shall make it a subject of discussion at our next meeting and will more fully report after the meeting.

At a meeting of the Rhode Island Horticultural Society held April 18, 1906, the following preamble and resolution was unanimously adopted:

"Resolved: That the Rhode Island Horticultural Society approves of the measure on foot in some of the states of the Union to procure from Congress the passage of a National Law which shall regulate the packing, grading and marking of fruit all over the country."

From W B. Flick, Secretary Indiana State Horticultural Society, Lawrence, Ind.

Your favor of the 27th ult. concerning the propriety of calling a conference on the desirability of a national law regulating the grading and packing of fruit for market received in due time.

In answer would say that Indiana needs badly a law regulating these matters. Much fruit is lost, the prices lowered and the demand lessened by improper and dishonest grading and packing. We do not have a state law even governing this and if we did have undoubtedly a national law would serve us better. This society will be willing to send representation to a convention called to consider the matter if notified in time. I would suggest that Indianapolis, Indiana, would be the best place to hold the meeting for obvious reasons. It is centrally located, has unsurpassed railroad facilities, good hotels, good halls for meeting, etc. I am sure halls, etc., could be procured without cost.

Please advise me as the work goes on and much oblige.

From Wesley Greene, Vice Secretary-Treasurer of American Federation of Horticultural Societies; Des Moines, Iowa.

I have your letter of the 27th ult., and in reply will say that I would favor a Fruit Marks Act similar to the one passed by the Dominion of Canada. However, I am not quite sure that a meeting called to consider that question alone, would be well attended, but united action might be secured through correspondence with the different organizations without incurring the expense of a convention called for that purpose.

From L. B. Bryant, Secretary of the Illinois State Horticultural Society, Princeton, Ill.

Your favor of the 5th came while I was absent from home. There is no question but what better grades and better packing of fruit is for the interest of all, whether for export or for home use. Whether it is desirable or practicable to secure this by law may be another matter. How to enforce such a law if passed, how to inspect without injuring the sale, whether to confine the requirements to such apples as were intended to be exported, and whether after all, the shippers are not the ones vitally interested and whose self-interest will finally force them

to require close attention to grading and packing, are not these matters about which there will be much difference of opinion and which will create much discussion?

It seems to me that matters of this kind are ones that might well come before an organization something on the lines of the "Federation" which was organized at St. Louis in 1904. An attempt was made to hold a meeting at Kansas City last fall at the time of the Am. Pomological meeting but I did not attend and did not hear what success was had.

Do you not think it would be well to follow up the suggestion contained in your letter and take a tour through this section of the country next winter and present the matter to as many of the state organizations as possible. A number of them meet during December and it would be possible to arrange a schedule that would cover quite a number in a short time.

If interest is awakened here it will be necessary to show just what the Canada law is and then in what way such legislation would benefit our people here.

I shall be pleased to assist in bringing this matter to the attention of our society at any time that it seems practicable to do so.

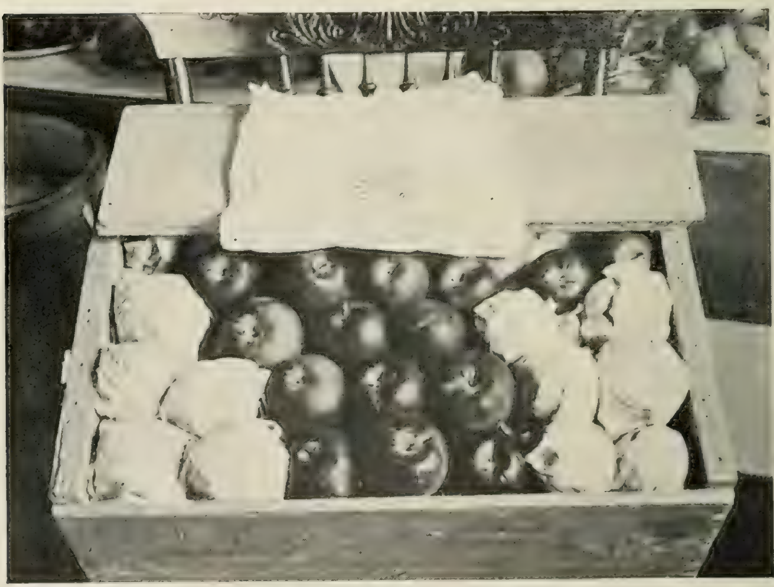
From Enos B. Engle, Secretary of the State Horticultural Association of Pennsylvania, Harrisburg, Pa.

Dear Sir: Yours Dec. 27, in reference to the grading and marking of fruits is received. Personally this is to me a very interesting and important question, not because I am either a grower of, or dealer in fruit, but because of my general interest in fruit growing, and whatever will conduce to fair and honorable dealing.

As yet Pennsylvania, while probably third in the rank of apple growing states, can scarcely be called a commercial apple state. We grow immense quantities of apples, but because of the great home demand and consumption, our fruit is scarcely mentioned in the commercial markets. We have a numbers of large orchards, but they are comparatively young, and it will be some years before they come into full bearing. But even for our local trade, and our home customers, the question is one of great importance and I hope some action may be taken to insure honest and uniform packing. Our annual meeting will be held in about two weeks (Jan. 16-17) and I will read your letter or

MAINE FARMER PRESS, AUGUSTA

A box of Maine Kings
By courtesy of editorial representative of N. E. Homestead



MAINE FARMER PRESS, AUGUSTA

A box of Hood River Jonathans
By courtesy of editorial representative of N. E. Homestead

submit it to a committee for such action as may seem best. I shall be glad to see our meeting take some measures looking to an honest and uniform standard of packing and marking. I enclose programme of our coming meeting. Would be glad to have you meet with us, and take part in our deliberations.

It will be seen that there is a general consensus of opinion in favor of such legislation as will insure more uniform grading and packing, the vital point being the framing of the sections of the act so that all that is possible may be secured without imposing unjust burdens upon individual growers. At the meeting of the International Apple Growers' Ass'n at Niagara Falls, Aug. 1, after a full discussion of this subject, followed the presentation of a paper upon "Inspection" by Prof. John Craig of Cornell. Resolutions were offered looking to adoption of standard grades on export trade. This law which it is the intention of the committee to try to have passed, is to be something like the Fruit Marks Act of Canada which provides for "optional government inspection." It was the sense of the association that this being a very important matter a committee should take it up at Washington and use every influence to have it become a law.

At the annual meeting of the Fruit Growers of Massachusetts I was invited to be present and discuss the question, much interest being manifested in the subject, the secretary, Prof. Maynard being constituted a committee to co-operate in investigating and deciding upon final action. As the result of the correspondence, discussion and action by different bodies I am convinced that it is a subject so vital that it may well engage our thoughtful attention, until, through united effort, a bill may be formulated and its passage by Congress pressed, which will insure to the growers of this country what now is impossible under the present makeshift method of grading and packing fruit.

One grower in Maine informs me that this year he sold his Nodheads to a dealer and out of fifty-three barrels they put up fifty of number ones. "Something," said he, "I could not possibly have done had I packed them myself."

We may profit today by selling our fruit in the bin, but the time will come when the reputation of Maine will suffer and the buyers will not then be known. The State must bear the responsibility and accept the loss. Another year strengthens the sentiment in Canada in favor of the Fruit Marks Act, and insures

its fruit an enviable position in the foreign market. Its fruit is no better than ours, but throughout the season the past year Canadian apples sold in the European market for an average of four shillings higher than New England stock. They obtained this higher price through the operation of their Fruit Marks Act and system of inspection. We lost because the bulk of our stock was sold to buyers who packed solely with reference to immediate sales and the possible profits of a quick turn.

Wanting a fixed system we wait in vain for the profit from the industry which others receive. This condition will continue until the fact is established that Maine fruit is all sorted, packed and branded by a uniform system which insures to the buyer just what the brand on the head, or the upper tier of apples indicates. In view of the experience of the year I am convinced that it will be wise to continue the work of interesting Growers and Fruit Associations in the subject and that the same appropriation, as made last year, be continued. Should a joint meeting be decided upon extra expense would be incurred.

A most important phase of the question lies in the fact that while other states are in a most serious condition, because of the San Jose scale, Maine is free. The situation grows worse in the West and Middle West and while the pest increases foreign countries have closed their doors to all fruit from these states infested. In this fact should be found our chief incentive to activity in order that we may insure the highest standard of uniformity possible in the fruit shipped from the State of Maine. If as there is reason to believe our climate is too cold for this pest to live, this scale being a hot climate insect, there is every reason for thankfulness and surely for extension of Maine orchards and honest grading of all fruit. Let us be prompt to act for our own interests.

This society has set itself to an important work in this direction and if in the years through co-operation with other bodies there is evolved what will insure to fruit growers of the State the place in the market which the quality of selected Maine fruit will fully justify, future generations will bear testimony to the valuable service rendered. We must not relax our efforts until such legislation is secured as will insure the grading, packing, and branding of our magnificent fruit crops under competent inspection and their sale upon the market for just what they are, the best apples grown in all the world.

RECENT DEVELOPMENTS IN THE APPLE INDUSTRY.

Prof. ALFRED G. GULLEY, Storrs, Conn.

It goes without saying that the most prominent subject of discussion today among fruit growers is spraying in its various methods and uses. Hardly a meeting of horticulturists can gather that the topic is not taken up. Still, the whole matter is comparatively new. Rather a marked exception to the old adage of there being nothing new under the sun. I doubt if there are many in the audience that could have given a formula for Bordeaux Mixture fifteen years ago. I might also add I am not altogether sure there are any now. Yet the importance of this work is not overestimated. But even now the growers who do not practice it are in the majority outside of certain limited sections, and unless replaced by other stringent measures, readily admit their mistake. At the exhibition of our State Society this fall, fruit from sprayed trees won in every contest over that not so treated. I am convinced that none of us yet have reached the limit of its benefit, and I can safely add the limits of spraying either. Personally I have reached the point where I think the spray pump must not stop till fruit picking begins. Have not as yet practiced it. The codlin moth has learned our customs and now waits till we stop spraying then gets in its work. Perhaps it would be more correct to say that it keeps on at work while we are taking a rest. Certain of our fruit diseases only make trouble late in the season.

You grow Greenings in this State. You have the fungus—I don't know as you do on Greenings. We have lots of it with us. We did a considerable lot of spraying this spring, up to the first of July, as usual, and then set the machine away. Along about the 1st or 5th of August I happened to go into one of the orchards, and in the center of it I saw quite a lot of Greenings that were in nice condition, trees loaded, and I detected on one or two a little beginning of that fungus, but that is as far as I went. I didn't go to spraying. By the time we got ready to pick those trees, some fifty barrels, there wasn't a solitary one not more or less covered by that fungus. What did it do? It

knocked a dollar a barrel out of every one of them. But if we had spent three dollars in time and material spraying those trees twice, it would have saved them—I am sure of it—because I know what it will do. That means spraying up to the time of picking on the Greening.

Question: May I ask the name of the fungus?

Prof. GULLEY: It is known as sooty fungus, or sooty blotch. (*Phyllachora pomigena.*)

Question: Looks like smoke on a chimney?

Prof. GULLEY: Simply begins as a little spot and then increases. You will see none of it until after the first of August in our state. Probably you wouldn't have it any earlier. It is no use to spray for it before then, and yet it is one of the easiest diseases to handle at the right time of the year, because it is all on the outside. You can wipe it right off. But apples will not keep if affected by it.

Question: Bordeaux mixture?

Prof. GULLEY: Yes, sir, and if I don't mention anything else, Bordeaux mixture is what I am talking about all the time. It is unnecessary to say to this audience what Bordeaux mixture is for, that we use it only for diseases—poisons are for insects, Bordeaux is not for insects. It is the hardest thing I have found for years to beat into our folks' head, what Bordeaux mixture is for. It is a remedy for diseases—nothing else. Do not ever use it for insects; it has no practical value there. For insects you must make emulsions or else poison them.

Our own operations the past two seasons satisfies me that it pays to use high power pumps or pressure, and with it we can, and should, use weaker mixtures. The barrel pump is all right for anything less than a hundred trees, but the man who is growing five hundred can't bother with a barrel pump that runs by hand. You won't do enough of it. It is too hard work. It means higher power, more costly machinery; and then you will do enough to make it pay. The barrel pump is very nice. We have used it a good deal up to within two years. Two years ago we started the gas. Last year we had a pump which you can run by hand power or by other power if you see fit. So far we have used it only by hand. But it is a double cylinder pump putting material on with greater force and more thoroughly onto the trees and increases the value of the spraying. A pres-

sure of a hundred pounds is necessary. You can get that with any of the common good barrel pumps but you will have to be lively and to keep it up. You soon get tired—that is the trouble with it. This high power spraying today is done in one of two ways. First, by direct power from engines of some kind, gasolene generally, or steam; by power direct from the wagons in various combinations; and by power of compressed air which may be pumped by the wagon and from that run the machine; and lastly by direct pressure of gases. This has been the spraying machine. Those are the powers that are used today practically. The man who has any use for a gasolene engine the year round, or a good share of the year, had by all means better use that, if he has a man who knows how to run the engine. If he trusts it to the ordinary man he will probably buy a new engine every spring. The pressure by air from the running of the wagon works very nicely in the West. I know of no one using it here. In the West I can see that it might be a practical machine to work; where the land is level and it is easy to run, that power is satisfactory. But in our hilly lands here it is rather difficult to run an engine properly on the up and down grades and irregularities that you find in spraying. And so a year ago, after looking the matter over, I induced our people to get us one of the gas sprayers. This is simply a tank made solid like a boiler in which we put the material for spraying, and then an attachment of the very same material that you made soda water of—that is all it is—in another tank, and by its expansion in this tank it makes the pressure and forces out the liquids. That is the whole process. The beauty of that thing is, the only kind of a man you have to have is one who can run a monkey wrench. I wouldn't hire that kind of a man if I could help it, but he will run it and he can't get it out of order very well. He may waste a lot of gas. It is hard to estimate the expense as it varies widely, but it takes from five to seven pounds of this compressed gas (of course the liquid form) to empty a hundred gallons of spray. A hundred gallons will spray from twenty to fifty trees, that depends altogether on the size of the trees. The gas costs from four to six cents per pound. You can make your figures from that.

Question: What is the material?

Prof. GULLEY: Liquid carbonic acid, that is all. It is just exactly what the soda fountain men buy, in compressed tanks.

It comes to us under a pressure of a thousand pounds to the square inch and sometimes higher. It can be obtained in Hartford or Boston, perhaps nearer. You can own these tanks yourself or rent them of the manufacturer. In the latter case you pay a little more for the gas. It works beautifully as far as we have used it. We haven't had to put our machine into the sulphur and lime yet, but for Bordeaux and all the ordinary emulsions it certainly works beautifully. We have not limited ourselves quite so much in help as they tell about. We have a man to drive the team, turn the agitator and watch the gas itself, two to handle hose. The tank empty weighs about five or six hundred pounds. By the time it is filled, with the gas tank and everything on it, there is about fifteen hundred pounds on the wagon. That is for 100 gallons. They make tanks for 50, 100, 150 and 200, I think. A hundred is large enough for most ordinary purposes.

With our high pressure we find we can use less and less and less of the copper sulphate making it cheaper and still effective. We used this year about three pounds to fifty gallons—we had previously used five in a barrel—getting just as good results in every respect. It puts it on finer and closer into the leaves and trees generally, so the same material will go farther. We are going to have an easier preparation to handle, experiments are being made along this line continually. You say you don't have the San Jose scale. If you have not, you have no use for sulphur and lime and you are fortunate. It is not pleasant stuff to undertake to handle. We are going to have other materials that will take care of the San Jose scale without using sulphur and lime.

Question: Won't you tell us how you use the sulphur and lime?

Prof. GULLEY: If you want to make sulphur and lime mixture, start a fire and in a kettle put twenty pounds of fresh, unslaked lime, with three or four pails full of hot water to slake it. Let it boil slowly, then add fifteen pounds of flowers of sulphur, adding more water all the while. Boil it an hour, during which time add 8 pounds of salt. It should then be about the color of an orange. Add sufficient water to make fifty gallons. You will in the end have a material of a wine color. Then you go out, and if your machine does not get clogged, you will do a

pretty good job if you are careful. That is sulphur and lime mixture. I am happy to say I haven't had to use much of it. But some are using it thoroughly and think that it is worth while to do it as a fungicide.

The sulphur is the only material which we use that is an insecticide and fungicide of any value. The scale is a live insect all the time although quiet a part of the year. The mixing of the sluphur and lime is the worst of it. If it is carefully prepared it will do reasonably well. Kerosene preparations sprayed on the trees are a little easier to operate and so far seem to show that they are going to take care of the scale perhaps as well as the sulphur and lime, but they are worth nothing as a fungicide.

I suppose the growers in this State are rather north of the scale belt, because I hear you don't have it in the State—so you may think. You don't know that, and the first thing you will know of it is you have a thousand colonies of it all over the southern part of the State. You will never know it—unless you have somebody watch for it that does know it—until the pest is so plenty that it is beyond all control to handle with any certainty whatever. That is just exactly the experience our people have had in southern Connecticut. It comes in before you are aware of it and when you think there is no possible way for it to come. I live in the northeastern part of the State. The county that I live in has very few orchards or men who are planting. As a result it has not been brought into that part of the State. At the College we are buying trees—getting new varieties—all the time and have been very careful to watch and keep clear of it, yet along in July or the first of August this year, we found a lot of currant bushes covered and where it came from I cannot tell or cannot imagine. I don't know that there is any within ten miles. About ten miles south there is plenty. It might have been brought from there by birds. If they left but one, that was enough. They are there now by millions. You have no idea of its propagation when it starts; and you can't see it, unless you are informed, until it has covered the plants thoroughly. I do not think you are entirely north of where it is going to live. You are not colder here than it is in Michigan, or in Central Michigan, or in the northern part of New York, or in Massachusetts, and it is pretty sure to come. You will get it on the imported trees if

you don't any other way. It has been scattered in our State a good deal by plants brought to summer homes. It may be only a little shrub and it will make the most beautiful center to start from, imaginable. Freezing all winter doesn't have any effect on it. It will increase in cold storage, I know that. I brought some infested apples from Boston in September to study the varieties. I did not have occasion to use them until January. The scale had actually increased in cold storage. They increase until the first of December in our section. There were lively ones to be found on the plants a day or two ago. Cold storage at 32 didn't stop them.

(We can give them 32 below.)

The scale will not propagate under that but it will not kill them all. Had 30 below in Northern New York. Those two cold winters did thin them out—that is not sufficient—if there is 99 per cent killed every year there will be plenty left to run the business.

Thinning overbearing trees is attracting more attention among our growers. So far only a few have undertaken it to any extent. The average grower cannot understand that it is a feasible proposition. Nor is it in the average orchard. The trees must be suited to the process. The past season has been the third bearing year that we have operated on the same trees. I wish to say here before going into the detail of the work, that no amount of thinning even to removing the whole crop at any time between blossoming and when the fruit was an inch in diameter has produced the least effect to make Baldwin an annual bearer or change the bearing year. On Fall Pippin we could see some results. In our operations the past season we made the usual mistake of not thinning enough, although in some cases we removed a full third of the crop. But where we operated was very evident to the casual observer, and the profit was equally evident when the fruit was harvested, in the change of grade.

We did go into exact figures with certain trees to see what the results were. With one tree this season we took off 3000 apples at the time we thinned them. Well now, at a very small size of apples, that was enough for six barrels. When we picked that tree we took off about 5070 apples. Probably another thousand nearly, dropped off in September in the hot days.

When that tree was picked eventually, and classified exactly according to the standard of apple shippers,—from two and one-half inches in diameter up for the first grade, two to two and one-half for the second grade, perfect apples in both cases, we had on that tree seven barrels lacking about a peck of first grade, one and two-thirds of second grade. The adjoining tree which was not thinned and which we supposed was about the same, we picked six thousand apples the day we harvested, and those went a little less than four in the first, and a little over four in the second. That was the result of thinning. It simply changes the size. The only mistake we made was that we didn't take off enough. Our average expense of thinning runs from forty to seventy cents per tree—the ordinary apple tree which you can get at reasonably. But it shows two years ago and this year that it paid not less than from seventy-five cents to a dollar a tree for thinning.

Question: How late would you thin fruit?

Prof. GULLEY: I should say wait until your apple drop is over. We have that sometime in June. It is not, however, a very serious matter with us as far as the Baldwin is concerned. Don't undertake it on trees that are not fitted for it. Now we have a few Suttons on the ground originally brought there from Sutton, Massachusetts, top grafted on Northern Spies, and if there is any apple that needs thinning it is the Sutton next to the Baldwin certainly. But that tree goes up like a Lombardy poplar, fifteen, eighteen or twenty feet from the ground. We had Greening trees that we picked this year, ten or eleven barrels of apples on each, over half standing on the ground. We had Baldwins that we had to use only a twelve-foot ladder to pick every apple on the tree. Those you can thin. On the other hand we have some Sutton trees that when the apples were on and the trees down as far as they would come the nearest apple to the ground was a little over two feet from the top of my head—cost a dollar a barrel, pretty near, to pick them. We did thin them, but not from the money standpoint. The man that grows the Sutton wants it headed down low.

The filler system of thick planting was practiced in the first of our college orchards and have now reached the point of needing thinning. This orchard was so planted to try the system, also to save space, but not wholly of kinds adapted to

this process. So far as they were, the complete use of the whole ground has proved a profitable one. We are now up to the thinning process. We were planning to begin cutting this fall, not whole trees, but only one side, or a portion where crowding the permanent trees, leaving the remainder to produce a crop or two more before the whole should be taken out. But a man, with means, fitting up a place, heard we expected to take out the trees and at once offered to buy them to plant again. So we shall take them up next spring and get paid for the labor. I am a little sorry because I wanted to work out the other system and we shall not have any more ready for five or six years to come. But the system to use is to cut away a part and not the whole at one time—perfectly feasible and no reason why it shouldn't be carried out perfectly. We have gone far enough to see that it pays to have the land all covered. In the matter of spraying the trees are in a nice bunch to work with. That very fact of pulling out the trees has given me a new idea; it is just barely possible a man might find it for his own interest to take those trees up and set them out on his own land. A man can arrange to get those trees out very cheap. You can pull them with cattle if you choose. I plant 16½x20 feet, with the idea of making them eventually 33x40 feet.

Question: What would you recommend for fillers?

Prof. GULLEY: I should put the whole orchard in McIntosh and go to chopping out when ready; and I should use McIntosh with Baldwin. Duchess is good; Wealthy is good.

Question: Wagener?

Prof. GULLEY: Yes, Wagener—that will depend how it does on your farm, if it does well—yes. It is a splendid apple.

Question: How about the trouble with fungi?

Prof. GULLEY: No worse on the McIntosh than on others. I am not talking to the men who are going to spray. It is coming to that, if you are going to sell apples out of this State.

Possibly one idea that occurred to me some years since and which I carried through to success, may be of interest to you. Yet I have been laughed at for seriously presenting it to be followed out. It is to grow the orchard, then plant it out. Briefly it is to grow the trees several years longer in the nursery row. Of necessity it must be done on the farm where the

orchard is to grow. Trees so grown must be transplanted several times and in the meantime given the same care in pruning and spraying that they should receive in the orchard. Just now I am operating on several varieties to note if all will take readily to the process. I find some difference but our principal kinds prosper under the treatment. As to its value, one-fourth of an acre will hold all the trees for a ten-acre orchard twenty feet each way, and could be cared for very cheaply, while the intended site of the orchard could be cropped without hindrance, or be better prepared for the trees if not already in good condition.

The discussion going on over the use of the box as a package for apples has induced us to give it a pretty thorough trial the present season. Dealers object to it. But its valuable characteristics are sure to bring it into use more for fine fruit. Our trial has been mostly with Sutton, as its color, quality and size adapt it to the purpose We packed two sizes, 110 and 150 to the box, the boxes holding about an even bushel. With us the barrel is hard to get, and cannot be made at home except on a large scale, while we can set up our own boxes when needed It is more work to put fruit in boxes and it must be packed honestly.

HORTICULTURAL POSSIBILITIES OF WORN-OUT FARMS.

Prof. W. M. MUNSON, Orono.

(Abstract.)

Systematic efforts are being made in several of the New England States to dispose of the "abandoned" or "worn-out" farms, or to reclaim them. It seems particularly fitting that this Society should use its influence in the latter direction, and should encourage any work looking toward the reclaiming of some of the holdings, which have for many years been neglected and practically abandoned. The fact is well recognized, at the present time, that these lands are not necessarily worn out, but that their condition is due more to the ignorance or neglect of their owners than to any inherent poor quality of the soil, or any lack of natural fertility.

There are many ways in which the neglected or non-paying farms of New England may be made profitable to their owners. One of the surest of these ways is by devoting the land to the growing of apples, and it is to the possibilities in this direction that the attention of the Maine Pomological Society is called at this time.

The younger generation can scarcely realize that fruit growing is still in its infancy in New England, and that in this direction is the most hopeful outlook for the future of New England agriculture. From the earliest settlements on the Massachusetts coast till the present day, fruit has been grown in New England. Peaches, plums, pears and apples galore have been introduced from England, France, and Belgium. But until about fifty years ago there was a very small amount of the fruit we know today; and that small amount was largely produced in the gardens of a few enthusiastic lovers of fruit.

Apples were then produced from natural seedlings, growing without care and attention, and were of more importance for cider than for any other purpose. Pears of delicious quality were grown, but mostly on a small scale for home use or for home markets.

But now all this is changed, we are beginning to recognize the fact that a large part of the area of New England, rough though it be, and difficult of manipulation for the ordinary farm operations, is well adapted to the production of fruits of the finest quality and highest color. We are beginning to realize that with a moderate annual expenditure for labor and plant food, we may reap a rich and sure return; that right at our doors are the best markets in the world for a commodity which we can produce as readily as we can make shoes, cotton cloth or wooden nutmegs.

Over much of the area of New England, the apple tree grows almost spontaneously; and wherever, in the past, seeds may have been scattered, we may find the trees growing. These old trees, though neglected and broken by storms, usually produce some fruit every year, and are frequently loaded to the ground. When given half the chance of ordinary farm crops these same old trees, regrafted to varieties of recognized merit, become the most valuable factor in the assets of the farm. In this connection I have in mind an old orchard in southern Maine, set more than eighty years ago, and naturally somewhat decrepit now. In three successive years recently, this orchard, covering about two and one-half acres, yielded 650, 400, and 350 bushels respectively; which brought the owner $480, $300 and $350, or an estimated net profit to the owner of 75 per cent.* These old moss-covered, neglected veterans, hardy as maples and refusing to die, stand as living witnesses to the possibilities of New England's hillsides.

Nor is the testimony confined to these old veterans. Very many modern instances of men who have accumulated a competence from old rocky pastures by the aid of the apple tree might be cited. Phineas Whittier, Maine's "apple king," began his labors as a fruit grower about 1850 with the purchase of ninety acres of most unpromising rocky pasture and woodland for the sum of $400—of which he was only able to pay $75 down. Apple trees were set wherever a place could be found among the rocks, and today there are substantial buildings, including fruit cellar and evaporating house, and the annual returns from the orchards, which now cover nearly 100 acres, are from $3000 to $6000.

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* Cited by D. H. Knowlton, Maine Pomological Society.

Only a short time ago, in conversation with the owner of an "abandoned farm" in Maine, the following interesting facts were brought out: The owner, a resident of Waterford, Oxford county, was a young married man and wished to branch out somewhat in his farming operations. In 1886 an abandoned farm of 136 acres, one and one-half miles from home, was bought for $650. This is what is known as a hill farm, and apple seedlings grow almost spontaneously. At the time of purchase there was a thick growth of natural apple seedlings over the abandoned field. Some of these had been top-worked, and that year yielded twenty barrels of fruit. The same year the owner set three hundred young trees and began grafting the other seedlings. Such wood and timber as there was on the place was sold on the stump at $4.00 per thousand, instead of spending time and labor in clearing.

During the first three years the young orchard was cultivated and planted to corn, the old trees being in pasture. Since 1889 the whole orchard has been in pasture, but there is an annual application of eight to fifteen pounds per tree of a fertilizer made up of 200 pounds nitrate of soda; 600 pounds muriate of potash; 600 pounds ground bone.

As indicating the earliness of fruiting, one of the top-grafting trees, the third year from grafting, produced three barrels of Baldwins, and the fifth year five barrels. The tenth year (1896) there were sold from the place 275 barrels of Baldwins at $1.00 per barrel—mostly from the top-worked trees, of which there were about 300.

In 1900	there	were	sold	600	bbls.	at	$1.43½	per	bbl.
" 1901	"	"	"	30	"	"	2.50	"	"
* " 1902	"	"	"	350	"	"	1.25	"	"
" 1903	"	"	"	350	"	"	1.75	"	"
" 1904	"	"	"	550	"	"	1.43	"	"
† " 1905	"	"	"	375	"	"	2.65	"	"

The high prices realized are due to the excellent fruit and the fact that it is held in a storage house—built on the place from the profits of the orchard—until the price is satisfactory. In 1900 and 1904 the *net* returns from this small hillside orchard on one of Maine's abandoned farms was nearly $500. In 1905

* Serious attack of pink rot.

† Sold in November.

the net returns were $700, and the orchard is not yet at its best bearing age.

In 1886 this gentleman in question was in debt $1500. In twenty years he has raised a sturdy family; paid every debt, and about $1000 in doctor's bills; built a stable, a storage house, and repaired other buildings; and has a snug bank account, substantially increased by the past year's returns. Best of all, his boy is an enthusiastic helper and will follow in his father's footsteps.

The case cited is not an isolated one. There are hundreds of farms in Maine, and no doubt in other sections of New England as well, that would give even better returns on a similar investment. Last year a farm of 57 acres, on which is a thrifty Baldwin orchard of 150 trees, was placed upon the market at $1000. This same farm has repeatedly returned $500 from the apples alone. The rest of the farm has been in hay until it is one of the "worn-out" farms; but the buyer of such property is sure of liberal interest.

I have not referred to the brilliant successes of Terrill and Kinney of Vermont; Ricker of Maine; Solon Chase, whose record with "Them Steers" is familiar to many; nor to the large operators like Hale of Connecticut, and others of Massachusetts, who have shown the possibilities in fruit growing. Suffice it to say, there are hundreds of small orchards throughout New England which during the past ten years have averaged their owners a net profit of 15 to 40 per cent on the investment. And this is better than raising corn at 25 cents per bushel 2000 miles from market, or than ten hours' daily work in the factory. It is better than raising hogs or even peddling milk. It is an occupation which takes a man out into God's sunlight during the day; which develops his powers of observation and his love for growing plants; and which leaves opportunity for home life, for study and for social development during the long winter evenings.

(The speaker here introduced letters from practical orchardists showing what had actually been done on "abandoned farms.")

VALUE OF ORCHARD LANDS.

In view of the recognized value of the orchard crop, it is indeed surprising that orchard land, in close proximity to railroad and steamboat points, should be held so low. It is more surprising that there are not numerous syndicates for the exploitation of these orchard lands. There is not the slightest doubt that with proper management the owner of apple orchards in New England is surer of a liberal return on his investment than is the owner of orange groves in Florida or of silver mines in the West.

One of the best orchard lands in Maine may be bought for from $5 to $50 per acre; and I know of hundreds of acres within 100 miles of Portland that might rival the great orchards of the Ozarks.

Orchards already in bearing, as in one case already cited, are sold at surprisingly low figures. But there is every indication that the tide has turned and that the fruit interests of the East are to receive a measure of the attention which their importance demands.

I would not minimize the difficulties attending fruit growing. Mice and countless hordes of insects and fungous enemies demand that the fruit grower be ever on the alert. But there is no business or occupation which will permit a man to "sit and sing himself away to everlasting bliss." The successful ochardist must wage an eternal warfare, just as is the case with any other successful business man.

AN INVESTMENT PLAN.

A few years ago the Secretary of the Maine State Pomological Society outlined a scheme for forming a fruit growers' stock company, which, while it semed altogether feasible, has not, so far as I am aware, been carried out in New England—though similar organizations are very successful elsewhere. In the West and South companies have purchased land, planted trees on a large scale, sold capital stock, and declared satisfactory dividends. What has been done there can be done in New England.

There are few if any absolutely safe investments that will appreciate in value as rapidly as a New England orchard.

Excellent fruit land may be purchased almost anywhere in New England, for $10 to $50 an acre. If set with desirable sorts of apples, and given intelligent treatment, these same lands will at the end of ten years be worth at a low estimate $100 an acre; while in fifteen years they will be returning a handsome dividend on a valuation of from $300 to $800 an acre. The increasing value of the orchard year by year, up to twenty-five years of age, is an important factor in the problem. To be sure the orchard must be cared for and protected during the first ten years. But this is not by any means a dead load to carry. Many of the lands which may be included in the tracts purchased, already contain profitable bearing orchards. Small fruits, or sweet corn, potatoes, and other hoed crops, may be grown in the young orchards to meet the expense of cultivation and fertilization. "Fillers" of Wealthy or some other early maturing sort, which will come into bearing in five years, will pay the expense of the orchard before the main trees reach their prime.

An invstment of this nature will certainly stand investigation at the hands of conservative capitalists.

POSSIBILITIES IN OTHER DIRECTIONS.

While I firmly believe in the future of New England as an apple producing region, there are many other ways in which the abandoned farms of our fathers may be utilized to advantage. The reclaiming of "poverty flats," and similar unpromising areas in other sections of Massachusetts, has shown the capabilities of some of these lands as market gardens. The unqualified success which attends the intelligent management of dairy herds in all parts of New England; the almost unlimited demands for the superior sweet corn which is grown in Maine and elsewhere; the success attending the extensive operations of Professor Sanborn of New Hampshire, in the lines of general farming; the rapid advance in the production of potatoes, since the introduction of improved methods; all of these, and many more actual commercial operations, go to show the possibilities in the direction of a new agriculture for New England.

"THE COLD STORAGE PROBLEM."

By Prof. MAXWELL J. DORSEY, Orono, Me.

Fruit growing has gradually developed from a neglected adjunct to the general farm to an industry of national consideration. It is regarded in its original light by some today, but that number is gradually becoming smaller. Its extent is such that commercial conditions are seriously unbalanced by even a partial failure of a crop in any of our extensive fruit growing regions. Growers, transportation companies and consumers suffer alike. The loss, however, is being felt less and less as the storage problem is being worked out.

Cultivating, pruning and spraying is one problem confronting the orchardist. But after the crop is grown and harvested in good condition another phase of fruit growing presents itself—and that is putting it on the market. Often as much toward financial success depends upon marketing the crop in proper season and condition, as upon growing a good crop. The efforts of an orchardist may result in little profit if it is necessary to market the crop when the "glut" is on. Here then is the province of cold storage.

The development of the storage industry within the last twenty years has been so rapid that its real extent is not generally recognized.

It is difficult to estimate accurately the present extent of the cold storage industry as applied to the fruit industry. No reliable data are available. There are probably from 1000 to 1500 storage plants in the United States today, handling fruit in some form. The number is rapidly increasing and no doubt they will exert a great influence upon the fruit industry in the future.

The application of refrigeration is not limited to holding fruit over season. It is now an extensive adjunct to transportation. Applied to both holding fruit over season and to transportation, the consumption period of fruit is not only lengthened, but growers are able to reach markets heretofore unsupplied. The storage industry, perfected along these lines, will enable every market to be supplied in and out of season.

Broadly speaking, there are two kinds of storage:

(a) The common method in which no artificial cooling is used, and

(b) Storage where low and even temperatures are secured by ice or mechanical refrigeration. Both systems have their place in fruit growing. They vary in effectiveness from the average cellar to the modern storage plant.

All fruits are not affected alike by storage. Some, as peaches, plums and berries, which ripen quickly, are not well adapted to storage; while others, as apples, pears, grapes, etc., have a longer period and are consequently better adapted to storage. Whatever the length of the ripening period may be, cold retards it.

The action of cold in keping fruit may be summed up under two general heads:

1. It retards chemical changes in the tissue of fruit, which, when acting normally, hasten ripening.

2. Cold retards or prevents the growth of bacteria and fungi, which cause decay. Fruit kept in storage often degenerates rapidly when removed on account of advanced chemical changes in the tissue. The apple seems to be the better adapted to storage requirements than any other of our fruits.

What temperature is best for the apple in storage? Experiments seem to show that the apple keeps best, scalds less, and rots are checked more at temperatures varying from 31 to 35°. Some apples keep better at lower temperatures than others. The ripening still continues in storage but not so rapidly.

How much more rapid does ripening take place in the average fruit cellar than in the storage? The following figures which will be given are those found in an experiment which I conducted in Michigan. The storage used has a freezing room which is cooled by the Cooper-gravity brine system. The cellar of the storage, which was used in the experiment, to compare with the storage room proper, is moderately dry, and I believe can be taken as an index to the average cellar. The average temperature of the freezing room September to May was nearly 35°; that of the cellar, 42°.

By January 6, 100 per cent of the Keiffer pears in the cellar had rotted; during the same time 3 per cent rotted in the storage. By May 22, 100 per cent of Baldwins stored in the cellar rotted,

as compared with 2 per cent in the storage. Between the same dates, the results on Spys were 21 per cent for the storage and 100 for the cellar; on Baldwins, 13 in storage, 100 in cellar.

These figures not only show the advantage of a storage over a cellar but they show what influence a small margin of 7 degrees F. has on the keeping of apples.

The length of time fruit will stand up after being removed from the cellar or storage depends upon its degree of ripeness. Some fruits go down very quickly. Some of the best storage apples will keep in good condition for weeks after being removed.

The maturity of fruit and the time elapsing from picking until being stored, determines largely the life of stored fruits. Twenty-one per cent of Spys stored immediately after picking rotted as compared with 49 per cent left in a barn ten days before storing. In Spys fully ripened, firm and well covered, 18 per cent rotted up to May 22 as contrasted with 62 per cent taken from the same trees two weeks later.

Tests were made to determine the influence of some of the common injuries fruit receives, during the process of picking, packing and marketing, such as breaking stems, bruising, etc. With Spys, Baldwins and Kieffer pears, breaking or pulling out of stems had no appreciable influence. The rotting seldom took place at the stems.

Rough handling gave very marked results. Seventy-two per cent of Ben Davis, drawn six miles, rotted, as compared with 13 not drawn and carefully handled; Spys treated in the same way, 54 per cent for those drawn six miles and 21 for those not.

There was little difference in the effect of scab and codling moth upon the keeping of Spys or Ben Davis. Pouring in barrels or boxes was very injurious. This is a common observation, but how much does it injure fruit? In the case of Spys, 81 per cent as compared with 21 per cent carefully handled; Baldwins, 70 per cent as compared with 13 per cent in those carefully handled. These records were taken in May.

Comparisons in many more of these points which come up nearly every day in handling fruit could be given. We all know injuries result from certain practices, but how much? It was an attempt to answer this question that the above experiment was conducted.

Often during harvesting time weather conditions are such that any delay in storing apples after picking causes severe loss. This may be avoided if a storage were near at hand. If the storage is some distance away, or cannot be reached except by rail, still there is a chance for a heavy loss. The heavy traffic which is being handled by the railroads often makes it impossible for them to render immediate service. Cars properly iced may be secured at a convenient distance from the orchard, even then the terminal service is such that the fruit cannot be placed in the storage at once. Again there is a chance for loss.

In view of these difficulties which are encountered at harvesting by one who attempts to store fruit, the question is often asked, "Is it possible for an individual, or a few growers in a community, to build a storage of sufficient capacity to carry their crop beyond the warm fall weather and incident low prices, to a time later on when the fruit can be put upon the market after the local product has been consumed, and in this way reach the higher prices?

This problem has been worked upon in Illinois and answered in the affirmative. Three storage houses having a capacity of about 2500 barrels were erected in different parts of the state, at a cost of about $3500 each. A temperature of 33° was maintained with ice for seven months at a cost of about $140. The total expense per barrel was 19 cents for the season. If the storage could be run at its full capacity, enough would be saved, taking 50 cents as the average storage charges for the season, to pay for the building in six years.

The advantage of having such a storage would be that the selling period could be greatly prolonged; the fruit could go into the storage at once, thus avoiding loss, and temporary packages could be used and the final grading could be left until packing.

In the future the development of the cold storage will greatly prolong the consumption period and enable the consumer to have fruit the year round. Over-production and resulting low prices will find a remedy. The market will demand a better grade of fruit. Only the better grades will be handled in the storage. Storing and marketing will receive as much attention from the careful grower as cultivation and harvesting.

MY NATURE STUDIES.

Miss Bernice Watson, Gardiner.

The word uneventful is often applied to the life of the country girl, and uneventful it certainly would seem if she did not observe and study the beautiful things of Nature which are all about her. The country is the home of countless villages of little people who carry on their business and private affairs in much the same manner as they are carried on by their human superiors. It was in the green fields and woods near my country home that I first began to study and love these little people.

My first study of Nature outside my observations at home began at Gardiner High School in 1902, under the able instruction of Prof. Powers. The fall and winter terms were devoted to zoology and consisted mostly of dissecting and drawing, outside of book study. Our first dissection was on the grasshopper. We separated the body into its three parts, head, thorax and abdomen, and again dissected the parts and mounted them on paper with the names of each. When done the mounts were very attractive.

During the fall term we studied the habits of some of the insects, and in the winter term again took up dissection, which was mostly on the crayfish, lobster, clam and other salt water animals that were obtained the previous summer by Prof. Powers. In the spring we took up the study of botany.

We had large books in which we mounted our specimens and fully described the parts and habits of each. Below each mount we drew some characteristic of the specimen.

At the meeting of State Grange in 1903, a prize was offered the different Granges of the State for the best collection of injurious weeds, and during the summer, Miss Thompson, a member of Chelsea Grange, and I devoted the most of our time to collecting. Our collection numbered 296 specimens and drew first prize for our Grange. The prize was offered the next year and we got a new collection and first prize again. At the State Grange meeting in Lewiston in 1904, we met Prof. Hitchings and at his suggestion we made a small collection of insects during the summer of 1905. Last winter the

State Grange offered prizes for injurious insects and this summer we have made a collection of about one thousand specimens, part of which is on exhibition in this hall.

I expect we have furnished considerable fun for some of our neighbors and friends. We have doubtless been called freaks and cranks, but as Burdette has said, "A crank, my son, is something that makes the wheels go round and insures progress," and I hope we are cranks in our own small ways.

During Teachers' Summer School at East Pittston, in 1905, Prof. Powers, Miss Thompson and I devoted considerable of our time outside of school hours to collecting botanical specimens. Prof. Powers organized a Nature Study Class, and afternoons we took long walks through the fields and woods. We carried trowels for digging our plants and vasculums for carrying them. Prof. Powers led us through briars and over stone walls, but he always knew where he was going and what he was going to find.

Most of my Nature Study has been field work and observations in the fields and woods. To study Nature one should be out with the things of Nature. A book full of things some one else has seen is not as instructive as having the little people themselves tell one of their ways and homes.

One of the best ways to study the life history of the butterfly is to collect the caterpillar, feed it, watch it eat and study its habits. When it has eaten all it wants, watch it go into the chrysalis state. The Black Swallow-tail which feeds on the carrots fastens itself to the side of some board or box, doubles its head a little under its body and slowly turns into a brownish chrysalis. The Polyphemus, a large green caterpillar which feeds on the elm, weaves a covering for itself of fine white silk. I watched one weave its cocoon last summer, and it wove a network around itself first, a part of the time having to stand on its head. Out of curiosity I began to pull the little silken thread which it secreted from its mouth. After secreting about two yards it refused to throw away any more, but it had plenty left and soon completed its winter home. The silk hardened when it had been in the air a short time and was as strong as fine thread. In the spring it broke open the cocoon and came out a moth. At first its wings were small and damp, but they developed quickly and after being in the air a short time became

dry and strong. The female moth lays her eggs on some leaf where the young caterpillars can feed when they hatch, and soon dies.

When one starts out on a collecting trip he should always carry a net, poison jar, a little box in which to put larvæ and other things he does not wish killed. If he is after dragon flies he should go to some bog or swamp where they breed, and there they can be found in great abundance in the different stages of development. The blossoms of golden rod and meadow sweet are always sure to have some beetle or fly on them. The flowers and insects are closely connected. The flowers provide the honey-loving insects with honey and while they are securing this sweet they fertilize the flower by carrying the pollen from blossom to blossom. Every flower hangs out a little sign which reads to the beetle or fly, "Honey for sale." In some blossoms like the mayflower it is the sweet perfume we all enjoy so much; in the carrion flower it is the offensive odor of decayed meat; but in both the sign reads the same to the different individuals it desires to attract. When the insect goes into the flower for the nectar it knows is there, it brushes carelessly against the little pollen boxes or stigmas and shakes the little yellow dust onto its body. It afterward brushes against the pistils and leaves small particles of dust on them. These go down into the lower part of the pistil, or ovary, fuse with the little ovules and thus the little seeds are made and immediately begin to grow, and in this way the insect pays the flower for the honey it has taken away. As soon as the flower is fertilized it takes in the sign and the parts of the blossom fall off and there is nothing left but the seed-pod or fruit.

One should study the lives of the insects as they are in their own little homes. Upon close examination one finds that the beetles, bugs, flies, wasps, etc., have six legs, while the spiders, harvest-men, etc., have eight. The bodies of many of the insects are made up of three parts, head, thorax and abdomen, the wings being fastened to the thorax. In some the head and thorax are so closely connected we say these insects are made up of two parts, cephalo-thorax and abdomen. Most insects have two pairs of wings; in the bugs and beetles the outside pair are hard-shelled and protect the delicate under wings, many

of which are bright-colored, as, for instance, those of the potato beetle. The upper wings of the bees and wasps have little hooks on them. When a bee wishes to fly faster than it can go when using its two larger wings, it hooks the smaller onto the larger and so increases its speed.

After returning from a collecting trip the insects should be kept in the poison jar until the muscles have relaxed before mounting. This generally takes about twenty-four hours. They should remain on the mounting boards until thoroughly dry—the time generally being two weeks—then removed to cases as near insect proof as possible. Great care should be taken in handling the moths and butterflies so as not to brush the scales from their wings and bodies. Even while looking at the mounted specimen one cannot help but notice the perfect blending of colors, the exactness and beauty in each curve and line, and when studying the live specimen, how many examples of industry, how many lessons of love and patience, they show and teach to those who are so far above them in the scale of animal life. This is one of the reasons why I think Nature Study should be taught in the public schools. It broadens the child's ideas and makes him understand more fully *his* place in the animal kingdom. The regular teacher should devote a short period each day to talks on these things, and once a week a Nature Study teacher should come to bring and explain specimens and assign a subject for the next week's study. She should be one who can devote her time to the study of insects and plants and be familiar with their habits and homes, who can tell of the things she sees to her pupils in a way that will enable them to see and understand her meanings.

Many of our regular teachers have had no especial training in lines of Nature work, and because of this lack they fail to interest their pupils on this grand subject. Every town, therefore, should employ a special Nature Study teacher who should go about from school to school, visiting each room in turn at least once a week.

During the Nature Study period the children's thoughts should be wholly on the subject under discussion, and if the teacher understands and is interested in her work she cannot fail of success. It is the child in the primary grade who should be taught the things that are all about him. In childhood he

should become familiar with the Nature World of which every child is a part, so that in manhood he can take his place in the more complicated world of action.

In one of the rooms which I visited regularly this spring as special Nature Study teacher, the pupils were so interested they would leave their seats and come to the desk without permission with questions for me to answer. At last the teacher told them they would have to remain after school if they did so again. It had no effect. They came just the same and I was obliged to tell them myself that they must stay in their seats if they wanted me to talk with them. The school was one of the best disciplined, but their interest in this study made them forget the regulations of the school. The pupils in this school were no exception to pupils in every school. Boys and girls the world over love the fields and woods, the hills and brooks, and they are always ready to respond when they are appealed to by the teacher. This teacher, as she leads them on from insect to flower, must show them the inter-relation between the animal and the vegetable world and the important part played by each in the economy of Nature.

She should teach them to be able to distinguish the beneficial plants and insects from the poisonous and injurious, to know where they live, and some of their characteristics and habits. Under her instruction they would soon learn that some of our most injurious insects are the beautiful moths and butterflies and that they should be destroyed; that the ichneumon fly is beneficial as it lays its eggs in the chrysalis of the moths and butterflies, and that these when they hatch feed upon and destroy the contents. She should also teach them to see the beauty and art in all things pertaining to Nature, and above all the love and nearness of the One who has put these wonderful things here for us to see and enjoy. She should lead the child to understand that he is a part of this grand subject and that he has a special place in it, and nine times out of ten she will find that Nature Study appeals to that big overgrown boy up there in the back seat who never studies but is always looking out of the window with a dreamy expression in his eyes. His teacher calls him lazy and dull, but see how his eyes brighten and his form straightens when the Nature Study teacher comes into the room. Watch him some day when he is playing truant

out in the woods and fields, where the things he is interested in are all about him. His eyes are bright, his movements are quick and alert. He is with Nature, and Nature's God has given him those things which enable him to see and understand.

He is not interested in his books and before he ever will be the teacher must show her interest in the things which appeal to him. If he sees she cares for the things he knows and loves, he will soon become interested in the lessons she is trying to teach him.

The boy in the other corner seat who always sits erect and has a bright, attentive look is also glad to see the Nature Study teacher, his interest in the things around him increases, and he thinks more of the love and power of the Creator of all these wonderful things. He is already interested in his studies and does not need to be appealed to as does the dull boy.

And so I say, Nature Study should be taught from the Kindergarten up. It broadens the child's ideas and gives him a greater desire for further knowledge.

Only those whose hearts are close to Nature and whose ears are ever ready and willing to hear and understand her many voices can appreciate the joy of the botanist when he comes upon a group of Mother Nature's children playfully hiding behind some fallen tree or huge boulder. What is there more pleasing on a warm summer day than a ramble in the woods where the flowers are to be seen in their home dresses? How restful and peaceful they look as the breeze gently sways their frail forms to and fro. They seem to be talking to each other and nodding their pretty heads in response to their neighbors' questionings. How many of us when we stoop and pick one of these little nature folk think that while we are only taking one blossom out of God's garden for our pleasure, we are at the same time preventing dozens of others from growing the next year. But Mother Nature is always glad to give us pleasure in our rambles and that is why she puts so many of her children where we can see and love them.

I do not believe there is any person, if he has any love at all for the things of Nature, who does not have a feeling of humble exultation when he comes unexpectedly upon a group of the Lady's Slipper or Moccasin Flower, clustered in some remote thicket. They have such a bashful, trustful look as they stand

with their fresh green leaves and nodding yellow heads in this cool secluded place. When we stop to read Nature's language, we know they are bidding us welcome, but if we should come upon them in a careless way, with no thought of the beautiful things around us, we would be unable to read the welcome and pass by the beauties of the wood without knowing the pleasure that might have been ours. In some shady place we see the Foam Flower and we cannot help but think how closely it resembles its name. The snowy white blossoms as they are gently swayed by the breeze make one think of the sea foam as it breaks on the rocks and beaches at the seashore. We go into some art gallery and gaze with awe at some beautiful painting. At a distance there is nothing to mar its beauty, but a nearer view shows little imperfections that have not been noticed before. It is not so with the pictures of Nature. The nearer we come, the more minutely we inspect them, the more wonderful are their designs, the more clearly their component parts stand revealed.

This world is God's garden and Dame Nature is the gardener. She teaches each spear of grass, each flower, each leaf, the love and goodness of God, and thus we, when we study and read the language of the things about us, cannot help but learn the lessons of love and purity.

HOW TO GROW DAHLIAS IN MAINE.

Mrs. Bessie M. Rupert, Portland.

The Dahlia is a tuberous-rooted perennial—a native of Mexico—and first discovered by Baron Humboldt in 1789. It was sent by him to Professor Cavanilles, of the Botanical Gardens, Madrid, who named it Dahlia in honor of the celebrated Swedish botanist, Professor Andrew Dahl. The same year, 1789, it was introduced in England by the Marchioness of Butte, who secured the plant from Professor Cavanilles. Although this plant was grown under glass and received the greatest possible care, it was finally lost, and was re-introduced into England in 1804 by Lady Holland. The plant was then introduced in France, Spain and Germany, where it received great attention and where it is still prized to this day as one of the finest summer and autumn blooming plants.

Other species were found and introduced from Mexico and became general favorites with botanists and gardeners, who raised many new varieties from selected seed. The first double variety was introduced in 1814. From this and several other varieties that quickly followed we get nearly all of our present named varieties.

Though found so close to the United States, the Dahlia was not introduced directly from Mexico, but was introduced from England shortly after, in the form of several improved varieties.

During the thirty or forty years of constant improvement which followed, the constant aim was to produce perfectly double, regular, ball-shaped flowers. The nearer a perfect ball they were, the more highly they were prized. This type had reached perfection by 1840 and was then considered the only type worth growing. At this time the Dahlia was the favorite garden plant with amateurs, gardeners and florists.

As the demand for Dahlias seemed to be assured, the florists continued to grow mostly the single and ball-shaped varieties, ceased to strive after new forms, and continued to grow the same varieties from year to year. Naturally a decline in the demand for roots followed, as many had become tired of the stiff form of the old variety, and others having a complete col-

lection of the kinds offered began to look about for something new. The Dahlia received less and less attention as the years went by until at last it became almost impossible to get good varieties true to name. Fortunately, however, the demand in England was for loose, graceful flowers, and new types were produced to conform to the general demand. Interest was at once revived, specialists took the Dahlia in hand and as a result we have cactus and decorative varieties that are marvels of superb beauty, not only in form but in their beautiful shades, tints and exquisite finish.

The demand for Dahlias has so increased in the past few years that they now form a part of the florist's stock of cut flowers, and thousands of blooms are daily used in the large cities in the making of exquisite bouquets, designs and decorations, many times at a higher price than paid for roses. There is nothing more useful as a cut flower than the Dahlia, coming as it does when other good flowers are gone. The flowers are both large and small, according to the variety, of every conceivable color, of exquisite texture and finish, and most of the varieties have long stems and beautiful foliage.

VARIETIES.

Dahlias are divided into two sections, double and single. Each section is again divided into classes, according to size, form and arrangement of colors. Double Dahlias are divided into five classes: Cactus, Decorative, Show, Fancy and Pompon. The Cactus is of quite recent introduction and is the most beautiful of all the Dahlia family. The flowers are very large, of most exquisite finish, soft, delicate, graceful, perfectly double, irregular in outline, loosely arranged, and almost all the varieties are borne on long stems. The petals are long and narrow, with the edges folded backward, instead of forward as in the ball-shaped varieties. In some plants the edges of the petals will actually meet, in others the petals are nearly straight. The coloring of this class, the blending of shades and tints, is surpassingly beautiful.

In form, Decorative Dahlias are about half-way between Cactus and Show Dahlias, being loosely arranged and of largest size. The petals are long, broad, beautiful and regular, though they vary some in the different varieties. The flowers have the

same exquisite finish and coloring of the Cactus Dahlia and both are strong growers and profuse bloomers.

Show and Fancy Dahlias are a branch of the old ball-shaped varieties, but are distinctly different in color arrangement. Show Dahlias are large, double to the center, very regular as though grown in a mould, and in some varieties the petals roll back to the stem, forming a perfect ball. They embrace the full range of colors, except blue, being either solid, self-colored or edged, or shaded darker than the ground color. This is the oldest form of the Dahlia and is better known and more universally grown than any other class.

Fancy Dahlias are very popular, owing to the beautiful combinations of color in the same flower. The term "Variegated" is more often applied than "Fancy," as they are splashed, mottled, penciled and margined in every conceivable manner and form. The flowers are large, beautiful and regular, quite variable as a rule, often showing but one color, showing fancy flowers in some localities and solid colors in others, with no apparent cause.

Pompons are also of the ball-shaped variety, having small, perfectly formed flowers, highly colored, many of them beautifully variegated. The plants are usually of dwarf, compact growth, and are always covered with a mass of flowers. They are largely used for cutting as the flowers are always small, have very long stems, and last a very long while after being cut. They are especially good for planting on small grounds, where a large collection is desired as they can be planted much closer than any other variety.

A perfect single Dahlia should have but eight petals and the petals should be of the same length. They are very beautiful and graceful and when better known will be included in every collection. In some the petals are long, narrow and irregular, sometimes twisted at the tip; in others they are broad and flat, overlapping each other. In the Collarette Single, there is a second row of small petals arranged like a collar around the center. They embrace the full range of colors, some being self-colored, edged and shaded darker than the ground color, others being spotted, striped and variegated in every possible manner. The flowers vary in size, the smallest measuring about two inches in diameter to the largest measuring eight inches.

CULTURE.

One of the most important points to be considered is location. To get the best results select an open situation, where the plants can get plenty of sun and air. They will grow and give some blooms in almost any place, even when shaded by trees and buildings, but no plant is satisfactory unless it does its best. Planted in the open garden they will bloom profusely until cut off by frost. Planted along an exposed walk or drive they make a beautiful and effective border. They can be massed or banked effectively and are good for bedding purposes. Some people train the taller varieties on trellises, others let them spread on the ground, giving the effect of a bed of low growing flowers. Planted in the shade they make a tall but soft growth and bloom sparingly. Dahlias are seldom a success, however, when planted under or too near large trees. The trees not only rob them of sunshine and air, but the roots, large and far-reaching, rob the ground of both moisture and nutriment.

Any moderately rich soil that will grow good corn will grow good Dahlias, if all other conditions are favorable. Sandy loam is best, however, as it will resist drought better. The plants are strong, robust growers, and are not particular as to the kind of fertilizer given as long as it contains the necessary elements for their development. Make the soil mellow by ploughing or spading a foot deep or more. Thorough preparation of the soil is essential as it not only enables the roots to grow deeper after moisture during dry weather, but affords good drainage after heavy rains.

Dahlias should not be planted till the ground becomes thoroughly warmed, usually about May 20th in this vicinity. The plants grow very rapidly and when planted about this time give better satisfaction than when planted earlier. Plants coming into bloom the latter part of August also give better satisfaction than those that come into bloom in July. However, tubers may be planted much later than May 20th. I had in my garden this summer four tubers that were planted about the 10th of July. I exhibited blooms from one of them at the Central Maine Fair, Waterville, September 11th.

Dahlias are propagated by seeds to produce new varieties, and by division of roots. Division of roots is the easiest and

most satisfactory method of propagation and the one followed as far as possible by all growers. As the eyes are not on the tubers, but on the crown to which the tuber is attached, care must be taken to see that each tuber has at least one eye. It is therefore best to start the eyes by placing the clump of tubers in a warm, moist place a short time before dividing them. Some people let the shoots get considerable size before setting them out as plants. I find that by placing the tubers in the ground direct, I get better, stronger plants than when I start them in the house. In buying Dahlias it is always wise to give strong field roots the preference, as they give better results the first year.

Many grow Dahlias from seed as an experiment, yet seeds are generally planted to produce new varieties only. Growing from seed is very fascinating owing to the uncertainty, as seeds do not reproduce the variety true to type, and then you may possibly get a new variety.

Plant Cactus, Show, Fancy and Single varieties three to four feet apart; Pompons two to two and one-half feet apart. Plant from four to six inches deep, according to soil and location, and cover from one to two inches at time of planting. Allow but one stalk to grow, and as it grows draw the soil in around it till the ground is level, but do not hill up. Pinching tall growing varieties just above the ground causes the plants to branch at the surface, thus making a stronger and more compact plant. Some growers use this branching system and consider staking unnecessary. However, staking securely is the surest protection against wind.

The plant will grow very rapidly and must be kept thoroughly free from weeds, the ground kept fine and mellow by frequent stirrings. Never allow a crust to form around the plants. Cease all deep cultivation before the plants come into bloom, and do not again stir the soil deeper than one inch, as immense quantities of feeding roots would be destroyed. Frequent stirring prevents excessive evaporation of moisture and keeps the under soil cool and moist. When the plants begin to bloom a heavy mulching of fine decomposed stable dressing will be found very beneficial, as it will help to make flowers instead of foliage as is often the case where the ground is made too rich at time of planting. If the supply of nourishment becomes exhausted,

the plants stop growing and the flowers grow smaller. People say they are "bloomed out," but they are really "starved out." The object sought in growing Dahlias—large, beautiful flowers, and plenty of them—is best obtained by feeding the flowers after the plant has developed rather than by feeding the plant before the flower appears. Some Dahlias bloom so freely that it is necessary to disbud them because the plant cannot supply nourishment enough to perfect all the buds that form.

If good strong roots are planted and the ground kept thoroughly cultivated, there will be little need of watering. If it is very hot and dry after the plants come into bloom, water thoroughly once a week, taking care not to wet the blooms. It is best not to let the plants suffer for want of water, not to water unless they need it, but when you do water them do it thoroughly, taking care to stir the soil the next day to prevent evaporation.

The Dahlia is unusually free from disease and insects. Cutworms sometimes cut off small shoots. You will always find the worm in the ground close by the plant it has cut off. As a preventive, use a small handful of slaked lime around the plant as soon as it comes through the ground.

As soon as the plants have been killed by the frost, lift the roots, remove the loose soil, and expose to the sun and air for a few hours to dry. Cut off the stalks quite close to the clump and pack not too closely in boxes or barrels, in a frost-proof cellar. A covering of dry earth or sand will prevent the roots from shriveling by excluding the air and preserving a more even temperature. Be careful, however, that the clumps are perfectly dry before covering.

In conclusion, let me say there is really no flower that will give so much pleasure for so little care and expense. It combines more good qualities than any other flower grown in the open garden, where it can be had in perfection from July until cut down by frost. The plant is a strong, robust grower, will grow in almost any position, and almost any soil, if given the proper nutriment. In the Dahlia can be found not only every color except blue, but every intermediate shade and tint from the softest to the richest, the most beautiful combination of colors, the most marvelous blending of shades and tints. There is even a green Dahlia—Verdiflora—which is quite a curiosity

on account of there being no true petals, and the sepals or bracts developing into petals. While there has not been a true blue variety produced as yet, many believe it is only a question of a little time, for there are already several purples containing blue shades. It is ease of culture, combined with its varied habits and adaptability to conditions, that makes the plant so valued and popular.

As a cut-flower the Dahlia is unsurpassed owing to its great diversity of form and its brilliant coloring. They vary in size from the smallest Pompons, measuring about one inch and a half in diameter, to the largest of the Decoratives, measuring six to eight inches—sometimes measuring even more. Dahlias can be grown to perfection in any and every garden, with but little care and expense, if attention is given to their simple requirements. No matter how many other plants may fail to thrive, or whether the season be wet or dry, you can grow them successfully if you but try. If you admire beautiful flowers and want them in profusion from July till frost, plant Dahlias and you will be delighted.

HOME INDUSTRIES FOR FARMERS' DAUGHTERS.

Mrs. V. P. DeCoster, Buckfield.

I. FLORICULTURE.

Since it is no longer necessary for the farmer's daughter to go to the city, or become a country school teacher, in order to become self-supporting, we will consider a few of the many ways now open to them, by which they can acquire a good income and still remain upon the farm.

As the country is coming in closer touch with the city through telephone, rural delivery and electrics it makes it possible to carry on many kinds of business which formerly could only be done near a market. Greenhouses are now quite frequently found at some distance from cities, as they can take orders by telephone.

Women seem especially adapted to this kind of work, even though there is much hard labor connected with it. We have one lady in this society who owns a greenhouse in one of our

Maine towns, although not exactly in the country. She does the work herself, even to shoveling seventeen tons of coal each winter. She has everything planned and built in a way to make it as easy as possible.

She tells me that her greenhouse, which is sixty feet long, cost her $600, but she paid for it and the running expenses, during the first six years. She makes a specialty of raising carnations and roses in winter and bedding plants in the spring. One Marchiel Neil rose pruned last March and at Decoration time, sold five hundred blossoms, and cut over one thousand within three weeks. The plant was originally a La Marc rose and grafted at two years.

Another woman in the town of Turner began by raising tomatoes, pansies, etc., in her kitchen windows for her neighbors. Gradually she worked into cold frames, then hot beds, and as her business increased she built a greenhouse and worked up a good paying trade.

I know one lady who lives in a village where there are quite a lot of summer boarders who has bought gloxinia bulbs in the winter at $1.00 per dozen and had them well grown and in bloom in the summer and sold them at fifty cents each.

II. SMALL FRUITS.

The raising of small fruits has also been successfully carried on by women. Those who have attended some of our past pomological meetings have heard very interesting papers by women who have had practical experience in that line. I was visiting one day in one of our villages when a girl about fourteen years old drove along the street with an express wagon filled with boxes of cultivated raspberries. Evidently it was a regular day for her trip, for it seemed as though the women at every house were watching for her, and without being obliged to even offer her berries for sale, they were soon all gone at fifteen cents per box.

I recently visited a farm in Livermore where a young couple have built a new house and started into the small fruit business. This year from their Cuthbert raspberry bed, twelve rods in length and two rods in width, they picked 928 quarts; from Snyder blackberries, ten by two rods, 786 quarts.

I have also corresponded with a lady in that town who has an acre of raspberries, from which she has picked forty bushels. Most of these were sold fresh, but she canned about six bushels which she sold at 20 cents per pint or 33 1-3 cents per quart, and the jars returned.

Celery: In connection with berries celery is a profitable crop to raise. With only help from a man to prepare the ground a woman could raise hundreds of plants. One spring I raised six hundred small plants in the house. These were set out in solid beds, the plants about six inches apart each way. They were the self-blanching varieties like White Plume and Golden Self-blanching. The soil was *very* rich and moist, in fact it was on a slope where it had received the wash from the barn-yard. The plants grew so large and so closely together that they required no blanching except boards around the outside.

In the fall we lifted them carefully by the roots and set them in shallow boxes, a dozen in a box, and sold them in our village at seventy-five cents per box and thought that a good price. But a friend of mine has done the same thing and found no trouble in getting $1.25 per box. Families like to buy boxes to keep in the cellar, and the stores also will buy it that way.

III. POULTRY.

For a steady, all the year round work and income, I know of nothing better for a woman on the farm than poultry.

Keeping poultry by the hundreds of course is a very different matter from keeping a dozen or so and letting them pick up their own living. Women seem to be well adapted to managing incubators and brooders, and these are almost indispensable now in a large business. Hens are contrary things sometimes, and they won't always set just when you want them to, and if you want a nice lot of eggs to sell about this time, when it looks as though there is no limit to the price in Boston, it is quite necessary to have your pullets hatched pretty early in April. There is a great advantage in having them all just about the same age, as they can run together and have the same feed.

The methods now practiced in using dry feeds make the work so much lighter that one woman can care for several hundred hens.

Incubators.

When you buy an incubator get the best in the market, and get a *big* one. You can run a large one with almost the same work and expense as a small one, thus you have your chickens all of the same age, and if there should be more than you wish for there is always a sale for incubator chicks. In fact, one can do a good business in selling newly hatched chicks. Three years ago I sold several hundred and the next year had inquiries for two thousand more than I could furnish.

The cockerels hatched in March and early April will sell at a good profit as broilers in June, thus leaving the field clear to the pullets.

Colony House.

We like the colony house plan, building them about 7x12 feet and putting two Peep o' Day brooders into one house with from fifty to seventy-five chicks in each brooder. The pullets remain in the colony houses until time to go into winter quarters.

Thoroughbreds.

It pays to keep thoroughbred stock of some variety. Then your eggs are uniform and you can gradually work up a sale for eggs for hatching. The large brown egg always sells better in Maine and Massachusetts than a white one. Eggs sell higher in Boston than almost anywhere in the country. Last month for large brown eggs we got ten cents per dozen more than the markets near home were paying. So a person intending to go into the business will do well to consider the size and color of the egg as well as the kind of stock.

Poultry is one of the industries a woman can work at and still do her housework (if there is not too much of it). Two years ago I kept an account of what I made on chickens alone. From the cost of the eggs in the incubators up to September I cleared $56 in cash and I had on hand one hundred and six pullets worth one dollar each, thus making a total of $162. And this, you see, was only the chicken side of the business, as the man of the house was attending the hens and egg department.

IV. PRESERVES AND PICKLES.

Home preserves, jellies and pickles is an industry seldom found to any extent, and yet I know there is a large field open here at good profit. There are hundreds of dollars worth of fruit wasted which might be turned to profit. I have known several women to start in this business and give it up.

The trouble is, they try to compete with large factories in a low-priced class of goods. The only way to make it pay is to make a superior article and have private customers.

Why, do you know how the cheap jellies are made? Such ones as your grocer sells for ten cents a glass?

Let me tell you. I have had the privilege of going through one of the largest preserving houses in the country, where I saw the jelly being made. In a large room on one of the upper floors of the building were many bran sacks filled with the dried skins and cores of apples from evaporating factories. It is quite safe to conclude there might have been a little dirt on some of the skins. However, they were dumped into an immense iron kettle, water added, and they were then cooked a certain length of time, and then the juice was drawn off at the bottom and strained into a large tunnel and spout which went through the floor down into other kettles in a room below. Here sufficient glucose was added to make it the required sweetness, and it was again boiled till it became jelly. Then it was put into jelly tumblers, and after hardening, was sent to the labeling room, where girls pasted on all kinds of *beautiful* labels. The labels looked very attractive, with the names and pictures of different kinds of fruits, but the jelly was all the same, *apple skins and glucose.* Of course they made some better jellies and pure articles, but you never see those except in the high-priced fancy groceries.

Of course the farmer's wife who uses only good fruit and pure sugar, and buys glasses in small quantities, cannot compete with that class of goods. But there is a call for the pure article put up in an attractive package.

A few years ago we had so many Red Astrachans that there was no sale or give away for them, and I conceived the idea of making them into jelly. I made it just as nice as I knew how, and put it up in tall thin soda glasses, with paraffine wax

and paper over the top. The glass and jelly both were so clear that you could see to read through it.

Then I went to one of the high-priced fancy grocery stores, in one of our large cities, and asked the man who had charge of the jelly department if he ever bought home-made jellies. At the question a "tired look" came over his face, and he answered, "No, I don't any more. Just step here and see what I have on hand." Then he showed me a large number of common jelly tumblers covered with tin covers, under whose edges sticky drops were oozing down the glass, and as he lifted some of the covers I could see the jelly was covered with yellow and white mold. "There," he said, "I bought a number of dozen of those and I can't sell them at even ten cents a glass."

"I shouldn't think you could," I answered. "I don't want to sell such jelly as that. I have a nice jelly in an attractive glass, and I want a good price for it. I know people will buy it if they see it." Then he began to get a little interested and after some talk said I might send him a sample and he would consider it. So I sent a sample, and he offered me four dollars a dozen, of his own accord. And those glasses only held one-half as much again as the ten-cent glasses, but the glasses cost $1 per dozen at wholesale. The secret was the glass and the jelly were so clear it looked attractive at a glance.

One woman who has sold quite a lot of jellies this year to private customers in Massachusetts, gave me the following prices, which she has received:

Currant jelly, $3.60 per dozen or 30 cents per glass; apple jelly, $2.50 per dozen; wild grape jelly, $3.25 per dozen; preserved pineapple, per pint, 55 cents.

APPLE JELLIES.

By using different flavorings a great variety of jellies can be made from apples. Quince added to apple makes one of the very best. Many people are very fond of jelly from Porter apples. This can be made so clear that it will be almost white, but red jellies generally sell better than the light-colored ones unless the customer desires the particular flavor.

Apple jellies can be made well into the winter, thus prolonging the working season and making a good market for number two apples. A rose geranium leaf dropped into the boiling syrup gives a delicate flavor which some people like.

Apples can also be combined with other fruits which do not jelly easily, like the peach. When used with grapes, the apple juice helps prevent the grape from crystallizing, which so often is a trouble in keeping grape jelly.

CURRANT JELLY.

Currant jelly will bring a higher price than any other. I think raspberry and currant combined make even a finer jelly than the currant alone.

Currants are very easy to raise, with just a little work in using hellebore at the proper season to keep down the currant worms. It is a wonder to me that farmers do not raise more currants than they do.

Rhubarb is a valuable addition to the preserve department. People who do not care for it alone, often like it in combination with fruits. For instance, it can be used with strawberries and raspberries, by cooking it a long time first with sugar until the rhubarb is a rich jelly red and then just adding the berries to the rich syrup and barely scalding them through. The rhubarb gives a rich body and the berries the flavor. When carefully cooked with about one-third rhubarb to two-thirds berries, few people will even know the rhubarb is in it.

RASPBERRY SHRUB.

Raspberry shrub is also easily made on the farm where they have good cider vinegar, and in these days of punch, which is served so frequently, would find a ready market.

The best of jelly can be spoiled for market by a cheap glass. It is just the same in putting up berries, plums or other fruits in jars. If they are all mushed together in a kettle and then poured into a green glass jar they are not one-half as attractive as when put into a white glass jar and cooked in the jar. Many people make a mistake in cooking berries too long, which hurts both color and flavor.

PICKLES.

I have experimented also with chopped tomato pickles and know one can easily find customers for that even in country villages, The secret is to decide upon something you *know* you can make *first-class* and then hunt up your market. If you can make something a little better than any one else, stick to it and you can gradually create a demand for it.

I will give you a short account of what one woman has done in the city, and certainly a woman on a farm where so much of the material practically costs so little, can do far better. This account was sent me by a lady well acquainted with the person who did it. She was a physician's wife in Worcester. Her husband died very suddenly, leaving her with two small children looking to her for their support. It occurred to her one day as she heard a friend remark that she was going away for the summer and she "did wish she knew of some one that could put up her fruit and make her jelly and pickles for her"—why could *she* not undertake it?

The lady was delighted with the prospect and the work was engaged. If she could do for one, why not for many? As soon as it became known that she would do the work, orders came from far and near. She went to a commission house and purchased the very best fruit at wholesale prices, also her sugar in 100-pound sacks. Her jelly tumblers and jars she bought at wholesale, so she was able to make enough on her jars when the fruit was sold to pay for the breakage.

With material bargained for she was ready for business. Taking the fruits in order, strawberries, currant jelly, spiced currants, raspberries, blueberries, blackberries, cherries, crab-apples, plums, pears, grapes, and so on through the list of fruits she worked until pickling time; then came pickled pears, tomato pickles of all kinds, mixed and plain, cucumber pickles, canned ripe tomatoes, chili sauce, catsup and everything that could be thought of that would sell.

Unaided by any one, with the care of two babies, from early season till fall, on a gas stove, that brave little woman put up one thousand tumblers of jelly, which she sold for $3 a dozen; ninety-five dozen quart jars of fruit, which of course varied in price according to the fruit and the way it was canned.

She kept her books with the same care as any business, so at the end of the season she could tell within a cent where she stood. Her expenses for her business including fruits, tumblers, jars, sugar and fuel, amounted to seven hundred and fifty dollars; her net profit for her work was five hundred dollars.

There were slight losses from breakage and now and then a jar of fruit would be lost. On almost all her fruit she doubled her money, and that is, I believe, the rule for such things. In

many cases the jars were furnished by the parties. She said if she could have hired competent help there would have been no limit to her business, as her goods sold faster than she could produce them.

To do an extensive business, at a profit, it is needless to say that all materials such as glasses and sugar should be purchased at wholesale and as much fruit as possible raised on one's own farm, although it pays even to buy that at wholesale prices.

I think there is more profit in pickles than in jellies, as tomatoes and cucumbers can be so easily grown and our waste apples made into cider vinegar. I first experimented with the chopped tomato picalilli. I made up samples and sent a person through our village to the different houses, to take orders. Most of the ladies sent their own jars to be filled.

HOW TO FIND CUSTOMERS.

There are so many women in the city now who spend the summer months in the country just at the time when fruit should be put up that there is no trouble in working up a class of good paying customers, to the person who can furnish the desired goods. One needs only to make up attractive samples and show them to the summer boarders and the orders are sure to come. Every satisfied customer is sure to find you several other customers.

Now I have not given you any imaginary facts or figures, but simply what I know to be true either in my own experience or that of some acquaintance. I have experimented in this because all my boys are girls, and I hope they will not all want to go to the city, although one of them remarked she had rather be a school teacher than a canning factory.

Why is it, then, that there are so few women engaged in these kinds of business?

Let me ask you,—why is it that there are so few young men on our farms?

It is the same answer to both. They flock to the cities. Young men and young women think they can make more money and have better times in the city, and after they once get into the whirl, it is hard to get them back into the country.

Our boys and girls see our summer visitors come among us each year with white hands and dainty clothes, polished man-

ners and money in plenty, and the contrast makes their own lives seem bare of beauty and full of drudgery and petty economies.

To hear the city cousin talk of theatres and concerts and parties, it seems to the country boy or girl that their lives are narrow and hard and missing the pleasures of life. Most of our girls are teaching school, many of them in other states, for it is a fact that other states are always glad to get Maine teachers. I wish I knew how many of our girls and boys go annually to Massachusetts and New Jersey.

I asked some one why the Maine teachers were in such demand, when our training schools are behind many others, and they said it was because the boys and girls had a good foundation of health and character. In Massachusetts the training is so severe that in a large number of cases the students' nerves are in such a shattered condition when they graduate that they do not make nearly as good a teacher as one with better health and less training.

I do not wish in any degree to speak against teaching, for it is one of the noblest callings, but from the standpoint of health and earning a living, I believe any one of the callings I have mentioned, flowers, small fruits, poultry and preserves, offer a healthier, more congenial and as good paying a business as many others.

Most young people as soon as they are out of school wish to enter right into some kind of business already established, with the steady pay of so many dollars per week, and just so many hours per day. They do not have courage or experience to start out for themselves, especially if it requires a little capital. And after they once get to work in some store or mill, it is harder still to go back to the country and try new paths. And so they work on and on, spending every dollar as fast as earned —sometimes faster, and growing older each year, until by and by their nerves or health give way, and then they begin to ask, "What can I do to earn a living and get out into the country?"

There are thousands of such cases in every city—people anxious to get back onto the farm, yet with no money saved and health breaking down. Here is an example. A young man from New York City came to us early last spring, with shattered nerves, from too close work in an office. He did not

know how to milk a cow, hold a plow, or harness a horse, but he was well educated and smart and he worked with a will and intelligence all summer, and by September had decided to take a course in agriculture at Orono and will then buy a farm and go into small fruits and poultry. Quite frequently during the summer he received letters from acquaintances who had heard what he was doing, asking for information as to the possibilities for earning a living on a farm, and asking his advice as to whether they had better give up their situations and go into the country. But in most cases they were people who had families and had saved nothing, or their health was impaired, and they were utterly ignorant of farm work.

It is not safe to advise such people to give up a situation and try something new, if they have never had any experience. Many people have gone into the poultry business in that way, simply from reading poultry articles in which the profits were figured large and the work small. Nine people out of ten make a failure who do not begin small and work up to it.

Why, you and I would not dream of going into the city and buying out a store or factory and trying to run it, without any past experience. We know we should fail.

And so it is to the women and girls already on the farm or in the village that I am giving this advice. You have had some experience along these lines all your lives. All you have to do, is to have a little more courage and perseverance to branch out a little at a time and add to your business as the way seems clear. But don't *wait* for opportunities, *hunt* them up.

The trouble is, the farmer's wife or daughter thinks she can go into the poultry or preserve business and also do her regular household duties, and she finds it too much. No woman would expect to teach school, or be a stenographer or bookkeeper and also do the housework for a large family. If she expects to make a business of flowers, fruit or poultry, she must expect to put the same hours, work, capital, and business principles into it she would into other kinds of business. Of course they can be carried on in a small way in connection with a woman's housework, but then she could not compare it as a business with what she might earn in the city.

Let the city man and woman take their vacations in summer while you are working away among your chickens and gardens.

Your turn will come in the winter, when you can go to the pomological meeting, poultry show or the city and have just as good a vacation and just as much money to spend, and if you will only take pains to look into the lives of those people you will come back home, glad of your lot, and thank God that your lines have fallen in such pleasant places.

SUMMER MEETING.

The Summer Meeting was held August 21, 1906, with the University of Maine, Orono. The forenoon was devoted to viewing the campus and looking over garden and fields of the farm. After a basket lunch the party assembled in the chapel, and the meeting was called to order and opened by President Gilbert:

You are aware that there is more than one way of obtaining knowledge, gaining information. We read, we study, we draw from books, and in addition we can gain knowledge from observation; and the Field Day—Summer Meeting—of the State Pomological Society is designed especially to draw information from observation, object lessons, that we may put ourselves in connection with on these occasions.

We have been invited from time to time, and quite frequently, to visit this institution in our Summer Meeting, and this year we decided to do so, and make our observations on the College campus and the Experiment Station grounds here placed open to our view. That is what called us here today, and it is not the purpose on this occasion to spend any considerable time or to invite your close attention to remarks, speeches or anything of that nature, but to take something of the time with remarks on what we have seen, what we have found, or what the institution here has presented to our observation for the purposes of gaining information. So you will see that all the way through the work is informal.

It is proper, however, that we may have some words of greeting or welcome from Dr. Fellows, President of the University of Maine.

Dr. Geo. E. Fellows: I wish to tell you how pleased I am, and for the remainder of the Faculty and all connected with the

Institution, how pleased we all are to have your association come here to us. I hope that this is only the beginning of the use that the people of the State will make of the University buildings and grounds. There is always room here, and much of the time, especially in the summer, we are lonesome after the students are gone, and we should be glad to have the whole State use these buildings and grounds as they are, as their own property,—come here and have their meetings of associations, or even, if you please, merely picnics. I want the people of the State to be so familiar with this Institution, in its appearance and in its workings and in its plans of work, that they may know, wherever they may live, exactly what their State University is trying to do.

The statement of the laws is so clear and so plain that this institution was to be for the benefit of everybody, old and young, rich and poor, occupied in farming, industrial enterprises, lumbering, professions, or what not, that I wish to repeat it constantly,—that the University of Maine, as it is now, and State College as it was, is not only to supply a college course in agriculture and the mechanic arts, but, as the law says, it is to furnish a liberal and practical education to the industrial classes in the several pursuits and professions of life. And we are all "the industrial classes," and "the several pursuits and professions of life" cover the occupations of every one of us. Therefore this institution is for us all.

You are here from all parts of the State. I see before me a man from East Machias, in the extreme east of the State; another man from Farmington and that is almost as far west as we can go; and I think there are people here from Caribou, and I know there are others from near the coast at the south. So after all, although the company is not as large as we hoped it would be, it does represent every possible part of the State. I hope we may be able in the future to be more useful than we have been in the past. I hope that our Experiment Station and our departments in the various agricultural and horticultural lines will be able not only to answer questions but to furnish the latest information that can be obtained, whether we have it here or not, or obtain it from anywhere in the world where it may exist, to give to you, and have you feel that it is your right to ask for anything that can be furnished from an institution for the

furtherance of your plans and your work. We are the agents, you may say, of the people of the State, to find what is latest and best in every scientific, agricultural and professional line.

I close as I began: We welcome you, officially and personally and cordially to anything and everything that there is here, and we want you to help us build this institution to its highest usefulness to you and to all that come here as students, so that every professor and teacher here may be an agent for the promulgation of the best and the highest that there is in agricultural life and in all the life of the community of the State.

President GILBERT: As the representative of the society who has called this meeting, it perhaps devolves upon me as much as any one to express thanks for the welcome which is given us here on this occasion, and to assure the representative of the Institution, who has thus expressed their pleasure at our presence with them, that we are only too glad to aid in any way possible in furthering the knowledge among the people of what there is here to be found and what they are furnishing in connection with the educational work of the State. In our behalf, therefore, I extend to you cordially thanks for the reception that we are here and now receiving.

Prof. W. M. MUNSON: (For the Experiment Station.) For some years the Experiment Station has been doing what it could for the development of the pomological interests of the State. Most of you know that the work of the Station is very largely carried on away from the College. The reason for this I tried to express, is that the conditions here on this island—for, as you know, the college is located on an island in the Penobscot River—are not suited for orchard work.

Many of you had an opportunity to see one of the lines of orchard work being carried on by the Experiment Station, at the Field Meeting in the orchard of Mr. Pope two years ago, and the bulletins of the Station will express more clearly than I can do at this time just the bearing of that work. Suffice it to say, the purpose of the horticultural work of the Experiment Station at the present time is to develop an interest in Maine orchards, to aid in developing the orchard resources of the State.

We have for many years boasted that we have the natural conditions best suited to the production of the best fruit in this country, but it is to our shame that we have not developed those

natural conditions so that we can, and so that we do, actually produce better fruit and more fruit than is grown in some of the other sections of the country. It is to our shame, further, that our Canadian friends are going ahead of us in the packing and shipping of their fruit. As you know, the Maine State Pomological Society, in some of its past meetings, has taken steps looking toward the better grading and the better packing of fruit. In this effort the Experiment Station will heartily co-operate.

Another problem which confronts the fruit growers of the State is that of taking care of the fruit after it is packed, that is, the storage problem in connection with marketing. There are many problems connected with the keeping of fruit that the Experiment Station can and will assist in solving. The Experiment Station of Illinois at the present time is conducting some extensive experiments in the cold storage of fruit, and in the co-operative marketing of fruit. this is a very important problem.

As I have taken occasion in many previous meetings to say, the one thing that stands in the way of development of Maine, not only in her fruit interests but in many others, is that eternal Yankee principle of "trying to get ahead of the other fellow." Now our friends in California, our friends in Oregon and Washington, are going ahead of us, are driving us out of our own market, because they have learned the secret of co-operation. They have learned that they must stand together and send only the best, and if some of their fellows are not willing to do their best in putting up that fruit, they must be driven out of the association. Every man must do his best and then work together. That is what we must learn, and that is what we will learn, Mr. President, right here in this State of Maine before we take our place as the best orchard section of the United States, a place which I believe we will take in the not very far distant future.

There is another point in which the Experiment Station may assist very much. I have spoken of the importance of growing good apples. The time has come now, gentlemen, when if we are going to grow good apples, we must spray. We cannot rely wholly upon Providence. Providence is sometimes too kind, but Providence will not destroy all of the injurious insect pests and the injurious fungi. We must spray our fruit trees, just as we do our potatoes, in order to be sure of the best result.

Spraying is insurance, and it is an insurance, gentlemen, which we must learn to avail ourselves of. And in that work the Experiment Station is prepared to lend a hand. We are at the present time carrying on experiments in Kennebec County covering some three hundred trees, which will be reported in due time. I may say briefly, another line of experimentation is being carried on in New Gloucester.

The purpose of the Experiment Station then, at the present time, is not to do the work here at Orono, because we cannot. It is to do it in Kennebec, in Androscoggin, in Cumberland, in York, in Sagadahoc, or in Somerset,—to do a certain amount of demonstration work, if you please. Some may say not a very high type of experimenting station work. The highest type of experiment station work, or any other work, is that which shall do the most good for the people; it is that which shall bring right home to our own doors, knowledge—not necessarily some new idea, although that is a very important factor of experiment station work—knowledge which shall help the people of the State of Maine, the people of the United States if you please, to do things better. It is not only the man who does the most uncommon things, but it is the man who does common things uncommonly well, that is helpful to his race. Now, gentlemen, the Experiment Station hopes to do both of these lines of work, not simply in pomology, not simply in entomology, not simply in chemistry, but by taking up certain lines of all these factors, the Experiment Station as a whole is aiming to do that which may assist in the development of the horticultural interests of the State, of the agricultural interests of the State, and of everything which goes to the building up of rural life. And, I may add, although I was to speak simply for the Station, I may add that the College of Agriculture, the University, is working hand in hand with the Station and is doing everything in its power to supplement, to extend, to take to the people the results of experiments conducted not only here but in other parts of the world, and the two are aiming to do that which may best result in the upbuilding of the horticultural and agricultural interests of the State.

Secretary D. H. KNOWLTON: There are certain things today of which I am very glad, and so far as I say anything to you it will be with reference somewhat to that idea. In the first place,

I am very glad to be here at the Experiment Station of the University of Maine for the purpose of viewing the work which has been done here and which is being done.

I am glad of another thing. I don't know how many years ago it was, but it certainly was within my recollection when I visited the University—it was State College then—the campus and this location which has been made so beautiful in recent years was,—well, I don't know, I believe I told one of the trustees of the institution that it looked a good deal like a God-forsaken place if I knew what such a place was, and that feeling was intensified quite a good deal from the fact that it so happened that this visit was in the spring of the year, and those of you who have ever tramped over the ground in the spring of the year and know what Orono mud is know my feelings when I came here and found that it was almost impossible to get around here anywhere without getting into the mud. Well, I am very glad indeed that to a large extent those conditions have been wiped out. I think very little of this decorative work here was done before Prof. Munson came here, and it seems to me—I don't know how the University people themselves may feel in regard to the matter—but it seems to me that this society and the visitors here certainly owe Prof. Munson a large debt for the beautiful work which he has done in bringing out the natural beauties of this campus, in making it one of the most beautiful college campuses in the New England States. I have visited several—I don't know of any that are more attractive.

It seems to me that there isn't a hall here, or a building here which is any more attractive in its settings than Fernald hall right across the way, and nearly every tree and shrub that is placed around it came from within ten miles of Orono, perhaps less than that. It is worthy of the study of every one here, especially of every one who has looked upon a church with no decorations around, and very few churches in the State of Maine have any decorations around them. And yet of all the spots in the State that ought to be made beautiful and lovely are the churches. Again there are our school-houses, our school-grounds—how few there are of those that have any decoration to make them attractive to the children. They should be the most beautiful spots, if possible, in the whole community. So I say that today, if as a result of this meeting we can impress

this lesson upon some I shall be exceedingly grateful; if we could impress it upon all I should be exceedingly happy. Now that is one of the lessons I hope you may carry home, and I am going to ask Prof. Munson, in connection with making up the final report of this meeting, to give us for publication a list of some of the shrubs and plants in a suggestive way which we may utilize for decorative purposes.

DECORATIVE PLANTING FOR THE HOME.

Prof. MUNSON: One characteristic of the American people is the spirit of unrest, that spirit, you know, which drives a man across the continent to California; which leads a man to forsake his profession or forsake the pulpit and go up into the gold fields of Alaska; it is that spirit which leads a nation to overrun a new country and take possession, while the cabinets of more conservative peoples are querying whether it is necessary to interfere to preserve the balance of power. One characteristic of the American people also is their fondness for the word "settle." So fond are they of this that every account, from state debts to farm produce, is closed only by being *settled*. Young men will start in life and they say they have *settled*. But God pity the young man, or the young woman,—or both—who shall settle down. Now I admire in a young man, or a young woman, the quality which we may call snap, that good old New England quality of "gumption." Nevertheless if there can be united with those qualities, the quality of contentment or affection for environment, we have the best combination of qualities. So then the first consideration that distinguishes the son of Ishmael from the man who loves his home, is one of environment. I have often said that a man has no business to have a home unless he takes enough interest in that home to make it an attractive place for himself and for his family. And as our worthy Secretary has intimated, it is not a question of great expense to make that home place attractive. All that the man has to do is to go out into the woods and the pastures near by and bring in his arms the trees and the shrubs and the flowering plants which will make that place attractive.

There are certain principles which govern the planting of these trees and shrubs which I shall mention later. I cannot dwell upon that here, but simply this—plant in groups or in clumps, ordinarily, rather than a single plant here and a single plant there and a single plant yonder. Make a solid border, just as we have done around the base of this building. No matter if the plants are not all of one kind. So much the better. Make irregular outlines, instead of making straight rows like rows of tombstones. Get plants, if possible, which bloom at different seasons of the year. Get plants which give highly colored fruits part of the year, like high bush cranberry, other plants which give rich foliage in the fall, like our common high bush blueberry and like the staghorn sumach. In other words, make of your home grounds, a picture, the house being the central part of the picture and this irregular border of shrubbery and trees the framework for that picture. And above all, in the foreground have a beautiful, clean, smooth lawn. In these days, when you can get a first-class lawn mower for not more than $3.50, there is no excuse for not having a good, clean, smooth lawn. Don't mow the front yard for hay and then let it grow up to weeds the rest of the year. Thank fortune, many of our best farms at the present time are now *farm homes*, are kept just as well as our city homes.

Now there are just two or three principles I wish to speak of. The first is—Don't attempt too much. Don't crowd the whole yard full of individual plants. There are lawns with a flower bed here, and a rose bush there, and a honeysuckle there and a golden glow yonder—all made up into a crazy quilt. By all means avoid that. See a picture, not a single bush or a collection of bushes. Have the people exclaim as they go by your place "Isn't that a beautiful place?" but not "See that lilac bush!" or "Isn't that a pretty rose bush?" Let them see the whole thing and not a patchwork.

Now, as I have said, don't discard native plants because they are common. Some of you were with me this morning when we saw one clump of the common stag horn sumach. There is another clump, to which I would like to have called your attention, which we did not pass. There are a good many of those clumps around on the grounds because that is a favorite shrub for ornamental planting. Dig it up, make a good rich bed, set

this sumach in the ground and cut it down every year to about three or four buds, fertilize heavily with stable manure and you will get a growth of from six to eight feet the following year of a rich tropical plant that will attract general attention. In the fall you have those beautiful crimson colors which make one of the most attractive objects on your lawn. The mountain ash has already been referred to. That is just beginning now to show the color of its fruit. Down by the road you saw the bushes of the high bush cranberry coming into fruit. From now on that will be one glorious show of highly colored fruit and it makes a very attractive plant. Our common birches, our white spruce, our American holly or winter berry, sometimes called black alder, our common wild sumach; some will hold up their hands in horror when I speak of our hardhack for an ornamental plant, yet you will go to the nursery and pay for *spiraea tomentosa*, or *spiraea salicifolia* when you might as well go into the field and get hardhack or meadow sweet. All the difference is that the nurserymen grew one and the Lord grew the other.

Where can you find a more noble tree than the common hemlock, for certain places? Now some of you men that live on sandy soil will condemn me for what I am going to say, but for certain places, and on light soil, where can you get a better thing for certain effects than the juniper? Those of you who have seen it on the sandy plains around Brunswick will say "The idea of using that thing for an ornamental plant!" But do you know, it makes one of the best of ornamental plants where low growing evergreens have lost their limbs and you have a lot of bare trunks you want to screen.

Then our common white cedar, which is regarded as a weed, is nevertheless one of the best of things to make a clump to screen ragged evergreens.

In many shady places, especially on heavy clay land, where you want plants to grow and don't know what to put in, there are our common native dogwoods. Look on the north side of Fernald Hall. The whole distance there used to be a rough, cold, clay bank, where the grass would heave out, and it always looked bare and barren. We went out into the woods back here on the farm and got those wild dogwoods and set in there. The effect you can see. Then our wild cherries make very ornamental trees. Our white ash, our queen of the American forest,

the American elm, the birches, the hawthorns, our common thorn apples,—why they are catalogued at high prices by the nurserymen, but we can go right out in the fields and dig them up and get them for only the cost of bringing them in.

I have not spoken of the high bush blueberry. There is not a more attractive wild shrub in the State of Maine than the high bush blueberry, and it is readily cultivated in certain moist localities or in good loam soil. It won't do well on heavy clay. There is nothing in October which gives a richer foliage unless it be the sumach. Bittersweet, and clematis, among climbing vines, will screen the outbuildings. The common woodbine has relieved the bareness of these brick walls more than I can tell you.

I think if I had been a student rooming in Oak Hall I should have wanted to put up over the door, "Abandon hope ye who enter here." It was a desolate looking place. But it is the planting of shrubs, and the use of the woodbine upon the walls of the building, which has relieved that bareness, and which will relieve it in any of our homes. Break up, then, the hard line between the building and the walk. Irregularities in the outline of the building may often be relieved by putting in a few shrubs of the kinds that I have named.

Now there are just two or three of the nursery-grown shrubs that I want to call to your attention. They are not expensive and they are of the greatest value. These are the Japanese barberry, the *spiraea Van Houttii*—you can tell them you want that Dutchman's spiræa—the hydrangea, with which you are familiar, and the Tartarian honeysuckle. Now there are four shrubs among the very best we have, not expensive, and they are of great value for ornamental purposes. The Tartarian honeysuckle gives its rich pink bloom in June, and the fruit, as you saw it, all through the month of August and into September,—the rich red berries adding to the attractiveness by reason of the contrast with the strong green foliage. Another plant I didn't mention is the Japanese rose, *Rosa rugosa,* which is the best of the roses for general planting.

Now, friends, I just want to add to what Mr. Knowlton has said, in regard to the importance of every member of this society, every one who is interested in rural improvement, emphasizing the decoration of our school grounds, our churchyards and our

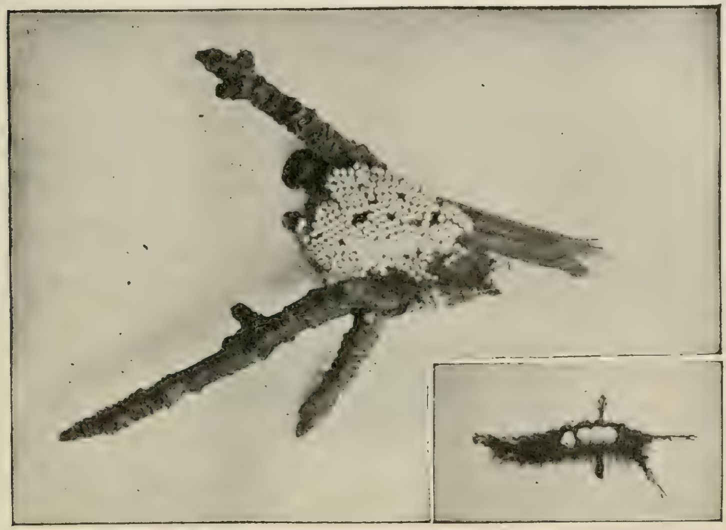
cemeteries. In Germany they have a very pretty custom of referring to the churchyard as "God's acre." In this country it would almost be sacrilege to refer to the churchyard as God's acre for it is too often apparently the God forsaken acre. Now friends, this is not right. Let every member of the Maine State Pomological Society and every friend of the development of rural interests help in lifting up the sentiment for the improvement of our rural cemeteries, our rural school grounds where the impressions of our children are formed, making the surroundings in which they are placed the most attractive possible, and then carry it to our own homes and make those places such that our children will feel that there is no place under heaven which is quite so attractive as the little old place where they were born.

TROUBLESOME INSECTS.

MISS PATCH: Almost three-quarters of the insects that are sent to us for identification are mistaken for the gipsy or the brown-tail moths. It is not necessary for me to inform any of you about the danger from either of these insects. You know about that well enough already. But it is quite possible that you are not familiar with these insects in all their stages, and if any of you care to see them from the egg stage to the adult moth, they are in the Experiment Station Building near by, and I shall be glad to show them to you.

The fact that we combat the brown-tail moth by cutting and burning the winter nests, keeps all orchardists on the alert for the things that look like winter nests of the brown-tail moth. There are a good many of the insects which make nests, which really do not resemble the nest of the brown-tail moth very much, but if you don't happen to be familiar with one it is possible to mistake the others for it. For instance we have the tussock moth, of which the caterpillar in the fall constructs its cocoon upon a leaf, which is very likely to remain upon the tree all winter. The moth which emerges in the fall deposits eggs upon the cocoon and you have that which looks more or less like a nest in the orchard during the winter. That is one of the common things that we look for and destroy during the

fall. A common web-forming caterpillar is the ordinary tent caterpillar which makes the large ungainly webs in the angles of branches in the spring. Many of the most troublesome insects are easily combated if you go about it the right way by spraying, as Prof. Munson has mentioned; and often there are other ways equally practicable. With the tussock moth, for instance, it is an easy matter to remove the egg covered cocoons during



Egg cluster of antique tussock moth.
Caterpillar of white marked tussock moth.

the winter. You have all the winter to do it in. In the case of the webs of the tent caterpillar, it is not difficult to saturate the unsightly web with some strong alkaline solution, strong soapsuds or kerosene emulsion or something of the kind, taking care to do it in the cool part of the day when the caterpillars are in the web, either early in the morning or toward evening, or on cool, cloudy days.

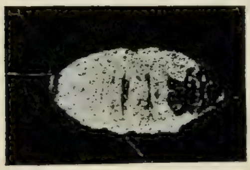
We have another web-forming insect which is very common throughout the State, and found very commonly upon orchard trees, the fall web worm, and that makes another large, ungainly web, not at all like the nest of the brown-tail moth, and differing from that of the tent caterpillar in containing skeletons of leaves, for the fall web worm encloses the leaves it eats instead of going out of its web for food as the tent caterpillar does.

The insects which are at this season most troubling the orchard are the red-humped caterpillars and the yellow-necked caterpillars and tussock moths.

The insect which perhaps has been sent in more than any other from all parts of the State this year, and mistaken almost constantly for the gipsy moth, is a dark, spiny caterpillar, which has been found commonly upon willows and poplars, and once in a while upon apples but not often,—a darkish caterpillar which grows to be nearly two inches long and has brick red spots along the back, and is covered also with black spines. That caterpillar turns into the yellow-edge butterfly,—the common large brown butterfly with yellow border about the wings.

This spring the insect which was troubling most in the orchard was perhaps the bud moth, and that winters in clustered leaves, so that when you are in search of the brown-tail moth next spring you will be likely to pick off the leaves that are harboring the bud moth and destroy that too. In fact this campaign

White marked tussock moth. Winged male.



White marked tussock moth. Female on leaf.

against the brown-tail moth is not only a very great benefit in keeping us on the watch for the brown-tail moth, but also for a great many other injurious insects. In hunting for the leaves that will contain the brown-tail moth you get rid of a great many others.

Rather than to detain you longer in talking about these insects, I shall be very glad to show you the insects themselves,

for it is more important in this connection to become familiar with the insects than to listen to a long description of them.

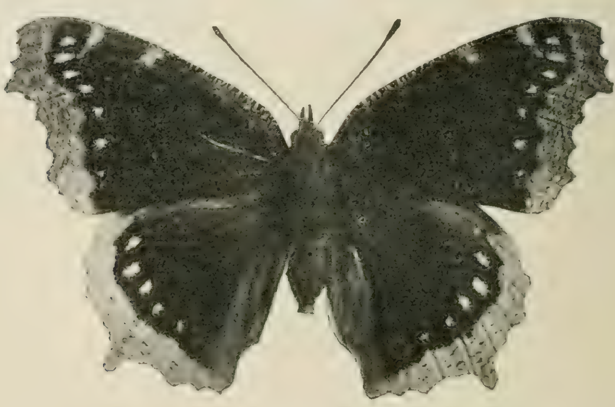
Prof. MUNSON: Several here today have asked what they should do to this red-humped caterpillar and the yellow-neck.

MISS PATCH: They are both very easy insects to combat. They are gregarious, that is, going in big colonies or groups, and if you will only look over your trees a little earlier in the season than this—well, if you had begun to look them over late in July, you would have found these caterpillars very young and in colonies of perhaps a hundred and fifty to two hundred right together, on the tips of the branches, and it is the easiest thing in the world to clip those branches off and destroy the whole brood. The trouble is, they come late in the season when we get over looking for the spring caterpillars and they take us by surprise. They come so late that it is rather a bad plan to spray on the bearing trees. Arsenical sprays, any of them, arsenate of lead or paris green will kill these caterpillars, and as the damage is most noticeable with young trees which are not bearing it is perfectly practicable to spray those. They are found too on the older trees but of course a colony will make more havoc on the small trees than on the larger ones. If you only get in the habit of looking over your trees before the caterpillars get so large and scattered over the branches, it is quite easy to remove the whole colony from the tip of the branch and destroy them by hand in that way.

Professor G. M. GOWELL: During the past three or four years I have planted out a couple of hundred trees down here on my little farm, and I find I am at work in another age. In the old days we only had to fight the mice and the bark lice and borers,—those were the only animals we had to fight. Now these trees are being beset—only put there three or four years ago—by something that eats every tree and branch and leaf, and I am having to fight them all the time,—another class of insects, of enemies. So that the work of growing an orchard today is very different from that of growing an orchard a few years ago.

Now regarding the work that the poultry may do in the orchard. I believe in it. And I believe in it because the ordinary orchard stocked to its capacity with poultry, hens and growing chickens,—there is nothing of which I know that will keep that orchard under such clean cultivation and prevent the growth of the grasses and weeds entirely, and if your orchard

is set on old sod or blue grass or red top, that will so completely destroy that old turf sod and work it out, as poultry; and they won't destroy the trees. They eat the apples, they destroy the insects, and they clean the land and put the ground under fallow completely. I could call your attention to orchards of two or three acres in extent, where two or three hundred hens have been kept for a period of years, where there is nothing growing on that land but the apple trees, and those trees are growing as they are not growing under any stage of cultivation except high actual manuring, as a result of this tillage given by the



Yellow-edge or mourning-cloak butterfly.

birds and the manure deposited there. My little orchard down here, where I am growing six thousand chickens this year—those little apple trees are growing so fast I am fearful for their wintering from the very fact that the manure deposited on that land is causing such a rapid growth there it is a question of stopping their growth rather than carrying it forward, and it is a question in these orchards that are intensely covered with chickens and with hens,—it is a question of the growth of the fruit, the quality of the fruit—fruit grows as fast as the trees grow.

And now were I to engage in growing an apple orchard today, I would select the land, if it were a forty acre farm, and I would put my colony houses containing one hundred birds around in that orchard, and would give a group of one hundred a certain area of that orchard, one row here, another row in that direction, and I would fill that orchard with hens and would put

that land under cultivation,—if I wanted to engage in poultry growing as large as that.

Now one thing more. I have thought about this matter of orchard growing a great deal. We have got a good area of land in this state that is not very valuable for agricultural purposes ordinarily, under the old systems we used to discuss of clean tillage and mulch. I would take a forty acre farm, and in the spaces between those trees set two rods apart, I would put in the plough and put that land into some crop that would grow me something I could mulch with. I wouldn't grow potatoes or corn. I would simply plough those strips in the spring and plant them to something that I might cut and pile around those trees so as to completely mulch those trees. I believe in mulching because it keeps the land under such conditions that we can get

Caterpillar of yellow-edge butterfly.

around a drought. The great difficulty is in getting mulching sufficient to cover the ground with. If we grow it somewhere else it is with considerable labor we bring it on; if we buy it is with considerable expense. If a man carries about forty acres of land, you know that means a good many apple trees, it means a business for that man. Make that land produce the mulch by the moderate fertilizing of the strips between the trees.

Now I think I have established the fact that I know something about growing apple trees.

I want to add one word to the words of Prof. Munson regarding the value of planting shade and ornamental trees on this campus. He has spoken about the advantages of beautifying the grounds. Every man believes in it and every woman. I will tell you one little incident that escaped him. Twenty-three

years ago we went, two men and myself, with a team one day and spent three-quarters of a day in bringing thirteen rock maple trees. We planted them about the house I live in. They have grown up into those magnificent sugar maples you saw today in front of the house,—twelve of them—one was lost. I think if any man in the country had money to buy that place for a home, paying three or four thousand dollars for it—it would probably sell for that if it was in the market—I don't believe there is a man in the country that is able to pay three or four thousand dollars for a home that would allow those twelve trees to be cut down for a thousand dollars, and yet we have not put an hour's time on the care of those trees since they were planted. Can you tell me of any line of work, agricultural or pomological, that has paid as did the planting of those twelve trees? Because there are thousands of men who are able to buy homes who

Chrysalis of yellow-edge butterfly.

would readily pay a thousand dollars for them; and they have a thousand dollars value today. There is something in this matter aside from merely gratifying the taste for beauty. It is a taste for comfort. Who would have those trees cut down such weather as this. It is something beyond beauty; it is comfort.

Question: "What can be done to encourage the farmers to raise more small fruit for home consumption?"

Question: How to prevent the railroad worm, from ravaging one's apples?

Prof. Gowell: What is the matter with the old hen?

Prof. Munson: The question of the railroad worm has been pretty thoroughly threshed out, but the *one* way we can combat it is to destroy the fruit in which it exists. That is one reason why the old hen suggested by Prof. Gowell is a very good preventive, destroying the fallen fruit. The use of hogs and sheep in the orchard for the same purpose is a very good prac-

tice. The picking up of fruit and destroying it by feeding to animals is also recommended. There is no way of spraying for the prevention of this insect. I may say that a few years ago there was a ray of hope held out by an experimenter in Mexico where they had been spraying the trypeta upon orange trees. I have made some trial of this material, which they sent up for

Yellow-necked caterpillar.

that purpose, but without any satisfactory results, and so far as I know at this time the destruction of the fruit is the only way to hold it in check. Don't leave the waste of the cider mill around and don't let the fruit stay on the ground and decay under the trees.

TID BITS FROM THE HARRISON BANQUET.

PRESIDENT GILBERT.

"Yes, we are the boys and girls,
And I sometimes have thought,
Shall we ever be men?
Shall we always be happy and laughing
and gay,
Till the last dear companion
drops smiling away?"

Who has a better right than the fruit-growers of Maine, who have brought their quota in honor of Pomona, to rejoice to meet in banquet and accept the hospitalities of Lakeside Grange?

Our society was criticised severely for coming way into this distant, uncivilized corner. Yet we are here, and I feel free to say that other localities will have something to do to get away from Lakeside Grange. I wish that I could find words to express the appreciation I feel in response to the courtesies that we are receiving at your hands here and at this time.

As I have looked across this hall and noted the individuals seated at these tables and have gone back to the forty years of public work through this State of Maine, from one corner to the other, mingling with and participating in public occasions connected with agricultural and pomological affairs, I have felt the contrast of the occasion at the present time with what I have experienced in the years long gone past. The work that has been going on through the organized effort of the State of Maine in the last forty years has been extending, not only information, not only education, but culture as well among the people of the State. And if you could contrast tonight the appearance of this company and the entertainment that we have received, with what has been my experience in those years long past, you would feel as I feel, that we are receiving compensation for the labors that have been put forth in the several agriculture directions in our State.

Secretary KNOWLTON: Before the meeting I came over here to see about the situation. Mr. Dawes met me and took me to his house. I have always found it a very pleasant place to visit. In the evening he brought me down here to meet the members of your committee—fine looking lot of men they are too. Lake-

side Grange has taken an immense amount of work upon itself. I have felt almost ashamed that we have permitted such a thing. And yet I am sure that in this effort, not of entertaining us, but of bringing people together in this cause, you are going to be more than paid for your trouble. I hope next year we may fall into as good hands as we have this year. We shall be fortunate indeed if we do.

At the Provincial Exhibition some years ago I judged the fruit. There were a lot of apples exhibited in barrels. It was the duty of the judge to pass upon these and decide which barrel of apples was the best. I looked them over very carefully and made up my mind which barrel of Gravensteins I was going to give first premium to and marked it. A little while after that a gentleman along very pleasantly to me. He says, "I don't want you to think I am a kicker, because I am not. I have come to you now for information. I don't know who is going to judge this exhibition of fruit next year, but I expect to be an exhibitor and I want to know why this barrel is better than that one. You have given this one the first prize, and this one the second." Well, I told him I was very glad to tell him. A judge can't always get out of scrapes as easy as I did. I said, we will take this and compare it with that. One lot of apples is just exactly as good as the other,—I wouldn't snap up a cent for the difference. Well, now let us take the details. This barrel over here is a little different, as you see, from that. The conditions require the best barrel of apples packed for market. This barrel that I gave the second premium to, when I opened the fruit there were a lot of newspapers on top of it. I don't know what the politics of those papers were, and I don't know as it makes any difference, but this other barrel had a piece of white paper on it. Now, I said, the barrel with the white paper looked a great deal neater to me, before I got to the fruit, than the other did. This is the first thing. Then I began to unfold some of the fruit. It was wrapped very carefully but it was wrapped in pieces of old newspapers. The apples in the other barrel were wrapped carefully with white, clean paper. I said, the wrapping here is a great deal better and nicer than it is there. Then, I said, there is another point. The barrel over there looks more like a lime cask than it does like a decent apple barrel in which to pack fruit. This one here is a finished

article all the way through. That is what won the prize,—the barrel is all right, the wrapping is all right, the fruit is all right. And that, gentlemen, is what in the long run will tell concerning Maine fruit, the best packer will win the prizes at the fairs and in the markets.

Mr. W. O. Breed: I think this is one of the proudest moments of my life. I had one or two, but this is certainly a great satisfaction.

I feel tonight very grateful to the officers and members of the society who have come from a distance and who have brought their exhibits with them. It certainly is an inspiration to go into the room below and look at those well loaded tables of fine fruit. One can hardly look at that display of fruit, if he is a fruit-grower, without resolving to try to do as well or better in the near future.

The growing of fruit in the State of Maine is one of the noblest callings that is occupying the attention of men. I will not confine that to the State of Maine—it is universal—but we are peculiarly situated it seems to me in the State of Maine, in that we are near markets where we can at almost all times sell our fruit at good prices. If I could go back at the age of thirty and know then what I think I know now, realize then what I think I realize now, I should dispute with the present Apple King of Maine, Bro. Whittier, or try to very severely for the title of the Apple King of Maine. Not that I would want that honor as a bare honor but I would try to grow so many apples and such fine apples that any other man would have to get up early and work late to be my equal in time.

Ladies and gentlemen, within the last twenty-four hours I have had very serious doubts about the wisdom of our laying ourselves out, as we may term it, for any such time as this, but the ladies of the Grange have worked nobly and succeeded admirably in the line in which they have been working, and to the friends who have come in here and so well graced this occasion by their presence I wish to extend the heartfelt thanks of Lakeside Grange. We are very grateful to you for your presence. It certainly is an inspiring moment.

Mr. Alonzo Moulton, Master of Lakeside Grange: We feel proud that the Pomological Society of the State of Maine has honored our town with their annual exhibition and we feel

proud of such a successful exhibition as is spread in the hall below, and we feel that thanks are due from us to the Pomological Society, rather than from them to us for what we have done for them. We feel that we have only done our duty, and Lakeside Grange always tries to do its duty.

I once heard one of our leading citizens say, "I have been in almost every State and I have investigated into the conditions in the various states and I have come back to the State of Maine. I have made up my mind that the State of Maine is the very best state in the Union. I have made up my mind that the County of Cumberland is the very best county in the State of Maine; and I have made up my mind that the town of Harrison is the best town in the County of Cumberland." Well, it is very natural that the town of Harrison should like such sentiments as that, and it is very natural we should like to have our visitors come here and go away feeling that they have been well treated.

Prof. Alfred G. Gulley, Storrs, Conn.: It has been my privilege to attend meetings of this sort for a number of years, and I have never attended a meeting of fruit-growers or any combination of the same that I did not have a good time. Your welcome began way back here twenty or thirty miles. I have traveled over many different railroads but today is the first time I ever traveled on a steam train where they gave you individual seats without charging you a dollar apiece. And the rest of the reception since I have been here has certainly been just as good —I might say better.

But our business is a splendid one and there is more in it than the money. That fruit grower who only sees money in fruit growing has not got the best end of it by a long ways. There is fun in it. I can see as much fun, and get as much fun and profit and enjoyment out of handling a tree, as any man can out of anything else, or as any woman ever did out of a poodle dog.

They are pets to me in my work. Our friend Breed says if he were thirty years younger he would plant some apple trees. Why, if you will go with me into Massachusetts, you may see an old man—late President of the State Horticultural Society and also of the Worcester Society—an old man today past ninety years old—and less than three years ago I heard him saying he was going to plant another apple orchard. Do you

suppose he expected to get money out of that? That man was doing it for pure fun.

Mr. LOUIS E. CLAY, (representing the New England Homestead): I have met many of the leading fruit growers of the state, not only at the meeting this year here in Harrison but at the meeting a year ago at Canton, the first Pomological meeting that it was my privilege to attend in this state. It seems to me there is a great deal of enthusiasm practically shown; practical experiences are talked over and you get not only the successes of the fruit growers but you get their failures. The talking over in open meeting of errors made by fruit growers and the suggestions of remedies form one of the most important phases of the meeting to my mind.

Surely the agricultural press has a very grave duty, if I may speak of it in that way, to exercise great care in placing before its readers only the best and the most accurate of information in any particular branch that it covers.

I can assure you that the interest which is being exhibited at this meeting is gratifying and at the same time pleasing, and I think if the fruit-growers will only realize what a power for good they hold in united action for the furtherance of their interests, they will find that the agricultural press will be of great assistance in aiding them in the direction of their own benefit and of course for the benefit of their children as well.

Mr. B. F. W. THORPE, (Editor of Maine Farmer): It is always an inspiration to a newspaper man to look into the faces of those whom he knows are working in the same line that he is trying to work. My visits in this part of Maine have been few, but I have found that Oxford and Cumberland counties are hard to surpass in Maine, and I think any other State. It has been my privilege to see some half of the States of our Union and see more or less of them. I have now been in Maine for nearly three years and have seen much of the territory of Maine, and I assure you that when I make the comparison between Maine and the other parts of the country, that I have no cause to regret that my field of labor is in this State.

Before coming to Maine my impression was like that of many others who have never been in the State. The line of travel to Maine, unless one comes as a summer visitor, is out of the track that most people get in, and they get the wrong impression of

Maine. I think New England is at fault, or has been at fault in the years past, in not making their territory known for what it is worth. New England people are naturally conservative, or at least have been, and they have not been willing to make a good thing known as the rest of the country has. For that reason they haven't reaped the benefit that they might have. The agricultural press, as my brother in the work has already said, has a large field of labor, and it is somewhat different from what it was before the mail facilities were what they are now. We must be more discriminating. Nevertheless, I believe we have a field fully as important as before. Now for instance, in regard to this meeting: There are many people in the State interested in horticulture who must depend upon the press to get their impression of this meeting, and it behooves us to present it in the best manner possible.

Mr. C. S. STETSON of Greene: The life of a tiller of the soil is one of the most independent, I believe, in the State of Maine. Our brother has spoken of Harrison—I guess Harrison is all right, but over here in Androscoggin County, the town of Greene—the place that I live in—with the possible exception of Harrison is the best town in the State. I believe in it. I believe there is no place like it, except, you know, Harrison. I believe in the State of Maine, I believe in its possibilities. I believe that there are possibilities ahead of the farmer in the State of Maine that we have never dreamed of in the past. And I say to you, my friends, that our fields are greener, and our skies are bluer, and our birds sing more sweetly, and our ladies are handsomer than in any other place that I have yet been in.

I want to say just one or two things and then I am going to quit. One is that I feel that quite a large proportion of the farmers in the State of Maine are doing the wrong thing. Now I believe that when we get in the place where we ought to be, when we study conditions, and when we make the most of conditions, and when we apply business methods to our work,—then we shall feel, and see, and know that there is no life upon God's footstool that is so independent as the life of the farmer. I believe this every time. Now I know numbers of men who are trying to do things that they can't do, who are doing things that they don't like to do, and who never have studied the conditions by which they are surrounded. I have seen a man who

would walk through an orchard and every time he went under an apple tree it seemed to me that that tree grew an inch and that its leaves lifted themselves toward heaven and thanked God that they had so good a man as that man was to attend to them. Another man might walk under that tree and poison it. This is just as true as you live, and I believe that the man who can do these things should raise fruit. I believe that the man who likes a hen and who can make a hen pay a dollar a year, should go into the hen business, and a man who knows a good cow as far as he can see her should go into the dairy business. I believe when we study the conditions by which we are surrounded, and when we do the things we like to do, and when we do them with our might, we may be sure every time that the balance will be on the right side of the ledger, and the boys and girls who are on the farms today will see the dignity of the life of the tiller of the soil. For it is to the boys and girls, and to the homes that we look for the future of the State of Maine.

Mr. J. MERRILL LORD, of Kezar Falls: In some sections of the State we are inclined to think that the teachings of the Pomological Society are not receiving as much attention as they ought to receive, but there is one thing—this section of the State is not one of those sections. You heard one of the gentlemen who came in the morning train express wonder this afternoon where all the people came from, saying "they certainly didn't come in on the train." It reminded me of a little story of a stage-driver. He was rather a perculiar character and many interesting stories were told of him. One day he had quite a load of passengers. A gentleman came to him and said "what is your rate from Rochester to Ossipee?" "Well," he said "I have three prices, 50 cents, 75 cents and a dollar—you may take your choice." Well he said he thought he would take a dollar seat and he asked him where the seat was and he told him to get right inside the coach. Pretty soon one of the fellows that paid seventy-five cents came along and he was told to get inside the coach, and then one of the fellows that paid fifty cents got into the same coach. He began to think he was being cheated a little and was thinking the matter over. They got started out and presently came to a bad place in the road and the coach stuck. The stage driver stopped, got down and says: "You fifty-cent fellows get out here and push, you fellows that paid

seventy-five cents get out and walk, and the rest of you keep your setting." The only trouble with the gentleman this afternoon was that he didn't count those that were pushing.

Mrs. V. P. DeCoster of Buckfield: I am just going to say a word of what this meeting means to me and what I think it does to a good many of us. Last week I had a letter from a young student who has gone to Orono this year to take the agricultural course. In that he said, "I can't tell you how much it means to me coming here. The very association with the students and teachers is an inspiration. Although I am handicapped by not being able to use my eyes and have to have my lessons read to me, the experience of being here and seeing the work done and the atmosphere of the student life is so uplifting that it is worth all it costs."

I think it is just that way with these pomological meetings. There is an atmosphere, there is a feeling of uplift, of inspiration, in mingling with these men and women that are interested in this noble work. For I know of no work that is nobler than raising fruits and flowers. As we study nature's laws and work in harmony with them in perfecting these wonderful things that God has given us, as we work along these lines striving every year to produce something a little better than has ever been produced before, it refines our characters and uplifts our thoughts; it brings us nearer to God in studying his laws. It seems to me that there is no work in the world that men and women can enjoy and can find more pleasure and profit, and fun as Prof. Gulley says, than in this work among the fruits and flowers.

Prof. Maxwell J. Dorsay: I am glad to be affiliated with two such organizations as we find represented here tonight,—the State Pomological Society and the Grange. This banquet is just what we would expect from the Grange, and the fruit exhibit below is just what we would expect from the State Pomological Society. I am glad to be affiliated with these two organizations whose object is not only the raising of better crops but living better lives and having better homes.

Solon Chase: I was seventy years young when I got the apple tree religion. When I was fifty years old I knew so much I couldn't learn any more, and now that I am more than eighty I see so much to learn that I am hardly sure of anything

only the Sermon on the Mount and the family Bible. This apple tree business is as old as the State of Maine is. We have today the finest country for apples that there is in the wide world. In the first place we have got the markets of the world, we are close to tide water. Now your Western states, they don't raise so good apples as we do, nothing like it, and they have got railroad freights to pay.

I had a letter from a Portland man the other day who wanted a couple of barrels of apples. I wan't ready to sell them and I thought I would put the price up where he wouldn't take them and I told him I would send them to him for $5 a barrel. The next mail the money came back. What we want to do is to raise better apples and more of them. We have got to educate the children in this apple tree business. If we do that we will cover this middle belt of the State of Maine all over with apple trees.

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The abbreviation "Sta." signifies the Experiment Station Report, and the abbreviation "Pom." the Pomological Report.